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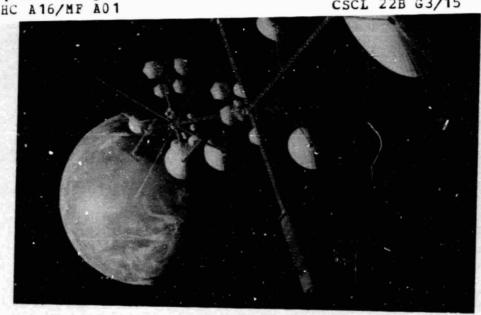
# GEOSTATIONARY PLATFORM SYSTEMS CONCEPTS DEFINITION STUDY

# FINAL REPORT VOLUME IIA APPENDIXES BOOK 1 OF 2

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SYSTEMS CONCEPTS DEFINITION STUDY. VOLUME
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Prepared by

GENERAL DYNAMICS

Convair Division

COMSAT

for the

National Aeronautics and Space Administration GEORGE C. MARSHALL SPACE FLIGHT CENTER Huntsville, Alabama



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### FINAL REPORT

# GEOSTATIONARY PLATFORM SYSTEMS CONCEPTS DEFINITION STUDY

### VOLUME IIA APPENDIXES BOOK 1 OF 2

JUNE 1980

Submitted to GEORGE C. MARSHALL SPACE FLIGHT CENTER National Aeronautics and Space Administration Marshall Space Flight Center, Alabama 35812

Prepared by
GENERAL DYNAMICS CONVAIR DIVISION
P O Box 80847
San Diego. California 92138

and

COMMUNICATIONS SATELLITE CORPORATION COMSAT Laboratories Clarksburg, Maryland 20734

### GEOSTATIONARY PLATFORM SYSTEMS CONCEPTS DEFINITION STUDY FINAL REPORT

VOLUME I	EXECUTIVE SUMMARY
VOLUME II	1 ECHNICAL ANALYSIS, TASKS 1 - 5, 3A
BOOK 1 OF 3	TASKS 1 AND 2
BOOK 2 OF 3	TASK 3
BOOK 3 OF 3	TASKS 4, 5, AND 3A
VOLUME II(A)	TECHNICAL APPENDIXES
◆ BOOK 1 OF 2	APPENDIX A – G
BOOK 2 OF 2	APPENDIX H – L
VOLUME III	COSTS AND SCHEDULES, TASK 6

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> William T. Carey, Chief Applications Group, PS06

George C. Marshall Space Flight Center

Huntsville, Alabama

1 July 1980

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### APPENDIX A

COMMUNICATIONS PLATFORM TRAFFIC REQUIREMENTS

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### SECTION 1 INTRODUCTION

In support of the geostationary platform systems concepts definition study for Marshall Space Flight Center, General Dynamics requires traffic forecasts, covering the 1990 to the year 2000 time frame. The requirements are for high volume trunking and direct-to-the-user communications services for platforms located appropriately so as to serve North America, South America, Mid-Atlantic, Western Europe and Africa. Traffic has to include domestic and regional satellite services, INTELSAT services, maritime and aeronautical services.

### SECTION 2 DOMESTIC AND REGIONAL SERVICES

Future Systems Incorporated (FSI) developed a 10-year traffic forecast for domestic and regional satellite communications. The forecast includes telephone and data services. Satellite service requirements are expressed in terms of equivalent 40 MHz transponders. Table A-1 shows the number of transponders for 1990, 1995 and the year 2000 for North America, South America, Western Europe, Middle East and Africa.

The projections for Western European countries should be viewed with some caution. We believe that our traffic model overestimates the actual traffic for the following reasons:

- 1. The European GNP/km<sup>2</sup> is high, leading to a very economical terrestrial communications system. Microwave systems are used extensively, and fiber optics will be added in the future.
- 2. As a result of extensive use of both C-band and Ku-band for terrestrial communications, the frequency coordination for earth stations is much more difficult than in the U.S., thus preventing the easy proliferation of earth stations.
- 3. In Europe, telecommunications is generally a government monopoly, and the telephone administrations of many European countries have generally been opposed to satellite communications for domestic applications and specifically for private corporate networks.

In addition, most European countries have a strict policy of requiring high local content for government controlled procurement.

It must also be noted that this model shows Iran using approximately 30 percent of the satellite traffic requirements for the Middle East. This may or may not be on the high side since the policy of the new government in Iran towards satellite communications is not yet known.

Table A-1
Satellite Traffic Requirements

	1990	1995	2000
North America	544	707	874
United States	455	574	688
Canada	47	59	71
Mexico	28	50	78
Central America	14	24	37
South America	113	199	309
Brazil	61	107	166
	7	13	20
Colombia	12	20	32
Argentina	3	6	9
Chile Venezuela	11	19	30
Others	19	34	52
Western Europe	438	568	690
France	81	104	127
	110	142	172
Germany Spain	22	28	34
United Kingdom	52	67	81
Others	173	227	276
Africa	36	62	95
Income Const	3	5	8
Ivory Coast	15	25	38
Nigeria	.4	.7	1.
Liberia	15	25	38
Sudan	2	3	4
Zaire Others	i	3	6

Table A-1 (Continued)
Satellite Traffic Requirements

	1990	1995	2000
Middle East	129	215	322
Algeria Egypt Saudi Arabia Iran Others	9 8 30 40 42	14 14 50 66 71	21 20 75 99 107

# SECTION 3 ATLANTIC INTELSAT SERVICES

The requirements for INTELSAT service for 1990, 1995 and the year 2000 for the Atlantic Ocean area are shown in Table A-2. This information of derived from INTELSAT's traffic data base and forecast and an extension thereof.

Table A-2
Traffic Model for
INTELSAT Atlantic Ocean Region Traffic

Year End	Number of Equivalent Voice Circuits
1990	54,780
1991	63,540
1992	73,710
1993	85,500
1994	99,180
1995	115,050
1996	133,460
1997	154,810
1998	179,580
1999	208,320
2000	241,650

#### SECTION 4

### MOBILE AND AERONAUTICAL REQUIREMENTS

Figure A-1 shows an estimate of voice channel requirements for maritime communications for the Atlantic Ocean area. This forecast is based on late provided by the IMCO Panel of Experts, Ref. A(1) as shown in the dashed line. The 1985 IMCO data point was then extended at annual rates of increase of 10, 15, and 20 percent. The median estimate of 15 percent reaches a requirement for 200 voice channels by the year 2000.

A forecast for aeronautical requirements was prepared y ARINC Research Corporation, Ref. A(2) in 1975. Table A-3 shows the ARINC estimates for the year 2000 forward and return channels. We have used this information to develop the traffic requirements presented in Figure A-2. The ARINC estimate corresponds to our low estimate. It excludes public correspondence service. The high estimate includes public correspondence service. A median estimate has also been generated.

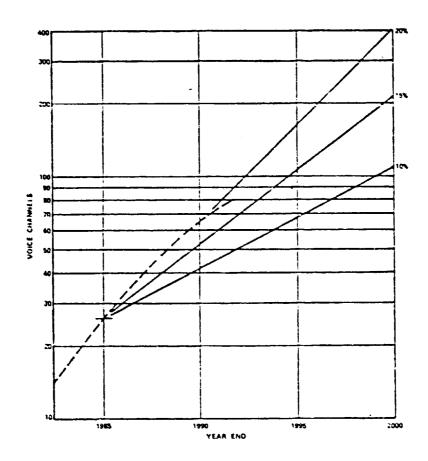


Figure A-1
ATLANTIC OCEAN
MARITIME REQUIREMENTS

YEAR 2000 TRAFFIC ESTIMATES BY ARINC FOR AERONAUTIC COMMUNICATIONS

Ocean Area	Forward Channels	Return Channels
Atlantic	6	9
Pacific	. 7	8
Indian	5	8

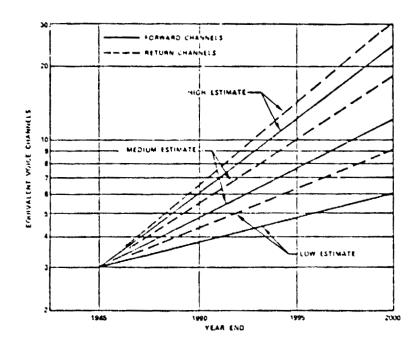


Figure A-2
ATLANTIC OCEAN
AERONAUTIC REQUIREMENTS
A-11

#### SECTION 5

#### TRAFFIC FORECAST

FSI has developed a 10-year traffic forecast for domestic and regional satellite communications. This forecast includes conventional telephony traffic and new data services traffic.

### I. <u>Telephony Traffic</u>

phone telecommunications, the model for telephony satellite traffic is based on correlation factors which have been derived from historical data, and which are applied to forecasts of future population and GNP numbers.

Tables A-4 and A-5 show the 11 world model zones and the countries that make up each zone. The current populations and GNP/capita for each zone is also given. This information is used in developing the population and GNP/capita forecast shown in Tables A-6 and A-7. When these two tables are multiplied the result is the total GNP, this is shown in Table A-8.

\$1,000 GNP for each of the world model zones. The telephone use per unit GNP is shown to increase with time, as it has in the past. However, the model shows that for the developed countries this trend starts to level off in the 1900s. Table A-10 shows the total number of long distance calls per year in the same format. This table results from multiplication of the data in Tables A-8 and A-9 (Long Distance Calls Per \$1,000 GNP).

Table A-4 Population and GNP Per Capita

World Regions	1979 Population (Millions)	Current Population Growth (% Per Year)	Current Inflation (% Per Year)	1979 GNP/Capita (1979 Dollars)	Current GNP/Capita Growth (% Per Year)
North America	244	0.9	7.7	\$10,980	1.4
Western Europe	416	0.8	9.6	6,590	2.3
U.S.S.R.	264	0.9	6.4	3,480	3.0
Eastern Europe	112	0.7	8.7	4,000	4.1
Japan	117	1.3	10.7	8,310	2.5
Group I Total	1,152	0.9	8.7	6,730	2.21
Latin America	349	2.8	34.4	1,520	5.5
Middle East*	174	2.8	11.4	2,260	11.9
China	927	1.8		470	4.1
Asia**	1,295	2.6	11.8	300	2.7
Africa***	330	2.9	14.4	380	1.0
Group II Total	3,073	2.4	20.2	610	5.6
Other Countries	67	2.1	11.3	3,580	2.5
World Total	4,292	2.0	10.4	\$ 2,300	2.9

<sup>\*</sup>Includes North Africa \*\*Excludes Japan and China \*\*\*Excludes South Africa and North Africa

# Table A-5 World Model Zones

### Group I

### North America

Canada United States

### Western Europe

Andorra
Austria
Belgium
Denmark
Federal Republic
of Germany
Finland
France
Great Britain
Greece
Iceland
Ireland
Italy
Liechtenstein

Luxembourg Malta Monaco Netherlands

Norway
Portugai
San Marino
Spain
Sweden
Switzerland
Turkey
Yugoslavia

### USSR

### Eastern Europe

Albania
Bulgaria
Czechoslovakia
German Democratic
Republic

Hungary Poland Rumania

### Japan

# Table A-5, Continued World Model Zones

### Group II

### Latin America

Argentina
Barbados
Bolivia
British Honduras
Brazil
Chile
Colombia
Costa Rica
Cuba
Dominican Republic

Ecuador
El Salvador
French Guiana
Guyana

Haiti
Honduras
Jamaica
Mexico
Nicaragua
Panama
Paraguay
Peru
Surinam
Trinidad
& Tobago
Uraguay
Venezuela

#### Middle East

Algeria Bahrain Cyprus Egypt Iran Iraq Jordan Kuwait Libya Lebanon Morocco Oman Qatar Saudi Arabia

Syria Tunisia Yemen, A.R. Yemen, P.D.R.

#### China

#### Asia

Afganistan Bangladesh Burma India Indonesia Kampuchea Malaysia Mongolia Laos North Korea Nepal Pakistan Philippines South Korea Taiwan Thailand Vietnam

# Table A-5, Continued World Model Zones

### Group II, Continued

#### Africa

Angola Benin Burandi Cameroon Central African Republic Chan Cape Verde Djibouti Ethiopia Equitorial Guinea Gabon Gambia Ghana Guinea Guinea-Bissau Ivory Coast Kenya Lesotho Liberia Malagasy Republic

Malawi Mali Mauitania Mauritus Mozambique Niger Nigeria Republic of Congo Reunion Rodesia Rwanda Senegal Sierra Leone Somalia Sudan Swaziland Tanzania Togo Uganda Upper Volta Zaire Zambia

### Other Countries

Antigua
Australia
Bahamas
Bhutan
British Soloman
Brunei
Burmuda
Canal Zone
Dominica
Fiji
French Polynesia
Grenada
Guadeloupe
Guam
Hong Kong

Israel
Maldive Islands
New Caladonia
New Guinea
New Hebrides
New Zealand
Portuguese Timor
Singapore
South Africa
St. Lucia
St. Vincent
Tonga
Virgin Islands
West Samoa

### Table A-6

### POPULATION (MILLIONS)

··· NORTH AMERICA	. 264.58 . 274.09 . 284.72
WESTERN EUROPE	449.40 464.25 478.63
· · · U.·S.·S.·R.· · · · · · · · · · · · ·	291.13 304.47 318.48
- EASTERN EUROPE	120.19 124.14 128.23
· · Japan · · · · · · · · · · · · · · · · · · ·	133.37 139.71 143.91
- Total Geove I	125913071354
LATIN AMERICA	451.73 500.29 550.63
MIDDLE EAST	226.58 251.47 274.29
· · · CHINA · · · · · · · · · · · · · · · ·	1092.30 - 1176.72 - 1267.66
···Asia••········	1627.74 1780.49 1928.16
· ····································	435.93 487.90 540.01
· · ·Total ·Geoup ·I·I· · · ·	38344197 4561
···OTHERS ······	74.0472.6470.78
······································	5166.98 5576.16 5985.39

<sup>◆</sup>INCLUDES HORTH AFRICA

<sup>◆◆</sup>EXCLUDES JAPAN AND CHINA

<sup>\*\*\*</sup>Excurres South AFRICA AND MORTH AFRICA

Table A-7

### - GNP PER CAPITA (DOLLARS)

	199019952000 .
· · NORTH AMERICA · · · · · ·	133621460815971 .
WESTERN EUROPE	8460947910620 .
U.S.S.R.	466053246082 .
EASTERN EUROPE	5834 6929 8229 .
JAPAN	109071234113962 .
TOTAL GROUP I	8620965010807 .
LATIN AMERICA	
MIDDLE EAST+	3666 4568 5693 .
CHINA	
Asia **	411 471 541 .
AFRICA+++	503 569 643 -
TOTAL GROUP II	93111291368 .
··· OTHERS · · · · · · · · · · · · · · · · · · ·	4700 5317 6016
······································	285831803558 -

<sup>\*</sup>INCLUDES NORTH AFRICA

<sup>◆◆</sup>Excludes Japan and China

<sup>\*\*\*</sup>Excludes South Africa and Morth Africa

Table A-7

### · GNR REP CAPITA (DOLLARS)

	199019952000 .
- HORTH HHERICA	133621460815971
WESTERN EUROPE	
EASTERN EUROPE	· · · · 5834 · · · · 6929 · · · · · 8229 ·
Japan	10907 12341 13962 .
· · Татец берше (I · · · · · ·	8620 9650 10807
- LATIN HHERICA	234128493466-
···MIDDLE EAST+·····	366645685693 -
· · · CHINA · · · · · · · · · · · · · · · · · · ·	
···ĤSIA◆◆·······	471 541 .
···ĤFRICA++ ·······	503 569 643 -
· «Татец «Берце» (II) « « « « »	93111291368 -
· · · · · · · · · · · · · · · · · · ·	470053176016 -
Татац	· · · · · <u>2</u> 8 <b>58</b> · · · · · 3180 · · · · · 3558 ·

<sup>◆</sup>INCLUDES NORTH HERICA

<sup>\*\*</sup>EXCLUDES JAPAN AND CHINA

<sup>♦♦♦6</sup>жсыйдея Фритн Агріса Амр Апртн Агріса

Table A-8

.....GNP (BILLIONS OF DOLLARS)

 3535 4004 4547 3802 4401 5083 1357 1621 1937 701 860 1055 1724 8009	1058 1485 1908 831 1149 1568 795 1047 1079 668 839 1043 219 877 347	348386425
MENTER DEPONDENCE OF SERVICE OF S	Latin America Middle East China Asiate Afracate Total Group II	Отнеяв

◆INCLUDES ANDRITE ARREGA ◆◆BXGLUDES JAPAN AND JULINA ◆◆◆BXGLUDES AND BURTH ARREGA

Table A-9

### - Long Distance Cauls PER \$1000 GNR

	1990 1995 2000 .
· · · NORTH · AMERICA · · · · · ·	8.709.479.98
WESTERN EUROPE	11.24 11.69 12.10
U.S.S.R	8.709.479.98
EASTERN EUROPE	8.709.479.98
· · · JAPAN · · · · · · · · · · · · · · · · · · ·	11.2411.6912.10
- LATIN ÁMERICA	8.70 9.47 9.98
MIDDLE EAST	8.709.479.98
CHINA	5.436.958.23
ASIA++	5.43 6.95 8.23
AFRICA***	5.43 6.95 8.23
···OTHERS ·····	8.709.479.98

<sup>◆</sup>Includes North Africa

<sup>\*\*</sup>Excludes Japan and China

<sup>\*\*\*</sup>EXCLUDES SOUTH AFRICA AND NORTH AFRICA

### Table A-10

### Total Long Distance Cauls (Michigns)

	199019952000
HORTH HMERICA	307633791945404
WESTERN EUROPE	42728 51462 61487
· · · U.S.S.R. · · · · · · · · · · ·	11805 15350 19337
EASTERN EUROPE	6102 8146 10537
- JAPAN	16348 20162 24305
Total Geoup I	107745 133040 161069
LATIN AMERICA	9204 - 13497 - 19055
MIDDLE EAST	7828 10880 15592
- CHINA	4319 7276 11347
··· ĤSIA++ ···········	3629 5829 8583
HERIQA◆◆◆	1190 1927 2858
TOTAL GROUP II	25570 39409 57435
· · · OTHERS : : : : :	
······································	136343 - 176107 - 222752 -

<sup>...</sup>Excudes South AFPICA AND MORTH AFPICA



<sup>·</sup>INCLUDES HORTH AFRICA

<sup>••</sup>Excludes Japan and China

The next step in generating transponder requirements consists of translating long distance calls into satellite call minutes. An average call duration of 9 minutes was used for this calculation, which was based on a summary of international statistics. Then, Table A-11 shows the percentage of long distance calls which will be carried on communications satellites during the 10-year study period for each of the world model zones. Table A-11 is then multiplied by 9 and then multiplied by Table A-10 to give Table A-12 which shows millions of satellite call minutes per year.

Traffic requirements are expressed in terms of typical domestic C-band transponders with an EIRP of about 33 dBW and a bandwidth of about 40 MHz and being able to carry about 1,000 multiple access one-way telephone channels as a weighted average for domestic applications. This measure was chosen merely as a convenient reference with which everyone is familiar. Actual domestic satellite systems of the future will use a variety of other arrangements.

Table A-13 shows the resulting telephone traffic in transponders or units of 1,000 one-way voice channels. This information is found by multiplying the data of Table A-12 by 17.4. The derivation of the factor of 17.4 is shown below:

- a. It was assumed that the total traffic is distributed over the equivalent of 2,400 busy hours per year. On this basis the Erland load is calculated as:
  - 1 billion call minutes/2,400 hours x 60 =
    6,944 Erlangs
- b. The trunk distribution and grade of service are such that the required ratio of Erlangs to circuits is 0.8. Therefore, one billion call minutes per year require 8,680 circuits.

c. One reference transponder handles 1,000 oneway channels or 500 two-way circuits. Therefore, one billion call minutes per year requires 17.4 transponders.

Table A-11

### PERCENT OF TRAFFIC CAPRIED WIN SATELLITE

	1990 1995 2000
· · · North America · · · · · ·	7.697.917.97
WESTERN EUROPE	4.61 4.88 4.96
U.S.S.R	7.517.827.93
- EASTERN EUROPE	6.387.417.78
Japan	4.60 4.86 4.95
LATIN AMERICA	9.7811.7012.91
MIDDLE EAST*	9.95 11.09 11.65
CHINA	10.7912.9413.99
···Isia	14.12 14.55 14.77
· · · · ĤFRIGA+++ · · · · · · · · · · · · ·	$\cdots$ 17.99 $\cdots$ 19.05 $\cdots$ 19.55 $\cdots$
OTHERS	7.599.3810.38

<sup>◆</sup>INCLUDES NORTH AFRICA

<sup>\*\*</sup>Excludes Japan and China

<sup>\*\*\*</sup>Excupes South Africa and North Africa

Table A-12

### TOTAL SATELLITE CALL-MINUTES (MILLIONS)

	1990 1995 2000
··· North America	212842699332583
Western Europe	17780 22581 27450
U.S.S.R.	79831080513808
EASTERN EUROPE	350654307379
JAPAN	6769 8827 10836
···Totel Geove I	572627463592057
LATIN AMERICA	809914211 22146
MIDDLE EAST	6472 10856 16347
CHINA	4196 8474 14290
Asia++	7635 11411
HERICA+++	198633035027
Total Geove II	253064448069222
Отневз	206730693967
TOTAL	84635 122184 165246

<sup>◆</sup>INCLUDES NORTH AFRICA

<sup>◆◆</sup>Excludes Japan and China

<sup>\*\*\*</sup>Excludes South AFRICA AND MORTH AFRICA

### Table A-13

### 

	19901995 2000 -
- North AMERICA	370.35469.67566.95-
WESTERN EUROPE	308.33392.91477.64
U.S.S.R.	138.90 188.00 240.26
EASTERN EUROPE	61.01 94.48 128.39
· · ·JAPAN · · · · · · · · · · · · · · · · · · ·	117.78 - 153.59 - 188.55 -
· · · Total · Geoup · I · · · · · ·	996.36 - 1298.65 - 1601.79
LATIN AMERICA	140.93 247.27 385.34
···MIDDLE EAST◆·····	118.68 188.90 284.44
· · · CHINA · · · · · · · · · · · · · · · · · · ·	73.00 147.45 248.64
···Asia••	80.25 132.85 198.56
AFRICA+++	33.52 57.48 87.48
Total Grove II	440.32773.95 - 1204.46
···OTHERS ··········	35.9753.4069.03
Тотац	-1472.65 -2126.00 -2875.28 -

<sup>◆</sup>Імоцирез Мортн Аграса

<sup>◆◆</sup>E×CLUDES JAPAN AND CHINA

<sup>◆◆◆</sup>Exchubes South AFRICA AND MORTH AFRICA

### Data Transmission-Domestic and Regional

Advances in computer technology and application have introduced new data transmission services which will be in extensive use by the year 2000. These services will require space segment capacity in addition to that which has been extrapolated from the historical use of the telephone system.

In a filing with the U.S. Federal Communications Commission (FCC) of April 1976, Satellite Business Systems (SBS) shows that 415 major U.S. corporations will create a market for satellite data transmission equivalent to 100,000 voice circuits by 1985. At 1,000 one-way channels per transponder, this corresponds to 200 equivalent C-band transponders. SBS states that the market is further increased by requirements from smaller corporations and from government agencies. To be conservative we have cut this forecast in half and applied it to each country or region in proportion with projected GNP growth.

The final correlation factor is about one transponder per \$20 billion GNP. The resulting transponder requirements are shown in Table A-14. The world total for the year 2000 is approximately 800 transponders.

Table A-15 shows total transponder requirements for each of the world model zones during the 10-year period of the study.

### 2. Data Transmission-Domestic and Regional

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Table A-15 shows total transponder requirements for each of the world model zones during the 10-year period of the study.

#### Table A-14

#### New Data Transmission Regularments (Transponders)

	199019952000 .
- MORTH AMERICA	131.08163.15191.43
··· WESTERN EUROPE ·····	130.12 174.69 818.02
U.S.S.R	46.43 64.34 80.78
EASTERN EUROPE	34.00 34.15 44.02
Japan	49.78 68.44 83.81
Total Geoup I	381.41 504.77 612.05
LATIN AMERICA	14.27 25.41 39.03
· · Middle East◆ · · · · ·	16.24 26.06 37.22
- CHINA	41.58 57.54
· Asia++	15.78 26.18 37.35
HERICA+++	2.96 4.94 7.10
TOTAL GROUP II	76.47 124.17 178.24
OTHERS	4.70 6.89 8.70
······································	462.57635.82798.99-

<sup>◆</sup>Incoures North Africa

<sup>◆◆</sup>E×CLUDES JAPAN AND CHINA

<sup>◆◆◆</sup>Excludes South AFRICA AND MORTH AFRICA

## Table A-15

### · Total Requirements (Transponders)

	1990 1995 2000 .
MORTH AMERICA WESTERN EUROPE U.S.S.R. EASTERN EUROPE JAPAN TOTAL GROUP I	501.43 632.82 758.38 438.45 567.60 689.66 185.33 252.35 321.04 85.01 128.62 172.41 167.56 222.03 272.36
LATIN AMERICA  MIDDLE EAST*  CHINA  ASIA**	. 155.20
OTHERS	

<sup>◆</sup>Імошорез Моятн Анятса

<sup>◆◆</sup>Excludes Japan and China

<sup>◆◆◆6×</sup>cuodes South Africa AND Morth Africa

#### LIST OF REFERENCES

- A(1) IMCO Panel of Experts on Maritime Satellites, Report to the International Conference on the Establishment of an International Maritime Satellite System. September 1974.
- A(2) A study of communications requirements for a 1985 to 2000 operational aeronautical satellite system, Volume 1, Atlantic Ocean Area, May 1975. Prepared for U.S. Department of Transportation by ARINC Research Corporation, Report No. FAA-RD 75-80.

APPENDIX B

VIDEO CONFERENCING FORECAST

#### **VIDEO CONFERENCING FORECAST \***

If an effort is made to provide inexpensive space segment, video conferencing will be an a tractive substitute for travel. In addition, the availability of video conferencing will stimulate its use for conferences which would have been held over the standard audio-only telephone system. This will be especially true for transoceanic conferencing.

Since video conferencing will substitute for travel, we have used reliable data on airline travel as a basis for our forecast of video conferencing requirements. Data on the number of man-flights per year was obtained from the F.A.A. Statistical handbook. Although the data is for the U.S. only, a strong correlation exists between the number of man-flights and the GNP per capita. We used this correlation to scale the U.S. data for other countries and regions. The relations are as follows:

Air Trips/1000 population =  $10^{(A \log x + B)}$ 

where

x = GNF per capita, 1979 dollars

A = 0.96 for international traffic

= 1.42 for domestic traffic

B = 1.8 for international traffic

2.6 for domestic traffic

Next it was necessary to separate out the business travel since we assumed that the use of video conferencing as a substitute for personal travel would be negligible. We therefore assumed (in the absence of data) that business travel was 50 percent of the total. We further assumed that every four airline trips (i.e., two round trips) replaced would require one 2-hour video conference. In an efficient system, one video conferencing circuit could accommodate 1600 conference hours per year. This is about 31 hours per week of actual use.

<sup>\*</sup>Prepared for General Dynamics by Future Systems, Inc.

In addition to replacement of airline travel, video conferencing would serve to replace some auto travel and would stimulate some video conferences where no trip would have taken place. In order to account for these other factors, we have arbitrarily introduced a multiplier of 1.5. Thus, the traffic forecast by the airline travel replacement is increased by 50 percent to take in these other factors.

We have chosen a conservative fraction as the portion of airline travel replaced and have varied it in order to show a range of possibilities. As with the introduction of any new service, the transition is likely to follow an "S" shaped curve, as shown in Figure B-1. The onset of video conferencing in the other areas of the world is likely to occur later than in the U.S. This effect is also shown.

The median assumptions have about 4.3 percent of U.S. air travel for business being replaced by video conferences in 1990. This increases to 9 percent by the year 2000. Corresponding factors for other regions are 1 percent in 1990 and 2.7 percent in the year 2000. The video conferencing forecast for this median model is shown in Table B-1.

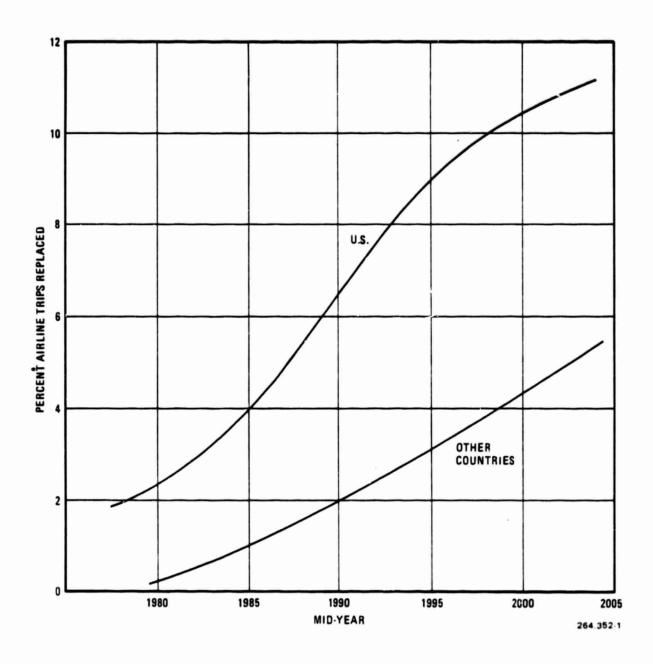


Figure B-1. Transition Curves for Video Conferencing

<u>Table B-1</u>
Median Forecast of Video Conferencing

	Video Conferencing Circuits in 1000's			
Region	1990	1995	2000	
North America	4.4	8.2	12.8	a 1. 1. 1.
Western Europe	0.9	2.3 -	3.8	( <u>)</u>
Latin America	0.2	0.5	0.9	₹.~•
Middle East	0.2	0.5	0.9	* -

The low estimate was derived by halving the median, and the high estimate by doubling the median. These forecasts are shown in Tables B-2 and B-3, respectively.

While there can be some argument concerning the exact numbers selected in the assumptions, the main thrust of the forecast is not the prediction of the actual future. The primary conclusion is that even if a rather small fraction of the airline travel is replaced by video conferencing, the number of video circuits required is quite large. Of course, the implicit assumption which underlies our forecast is that the video conferencing circuits and facilities be made available in sufficient quantity and at a low cost so as to stimulate the growth of the market. The quality must also be high enough to overcome objections to this form of conferencing.

Table B-2

Low Forecast of Video Conferencing

	Video Conferencing Circuits in 1000's		
Region	1990	1995	2000
North America	2.2	4.1	6.4
Western Europe	0.5	1.1	1.9
Latin America	0.1	0.2	0.5
Middle East	0.1	0.2	0.5

Table B-?
High Forecast of Video Conferencing

	Video Conferencing Circuits in 1000's		
Region	1990	1995	2009
North America	8.81	16.38	25.65
Western Europe	1.88	4.53	7.52
Latin America	0.33	0.95	1.88
Middle East	0.30	0.90	1.83

# APPENDIX C INTERSATELLITE LINK CAPACITY REQUIREMENTS

## INTERSATELLITE LINK CAPACITY REQUIREMENTS

February 4, 1980

Prepared for:

General Dynamics Convair Division P.O. Box 80847 San Diego, California 92138

Prepared by:

Future Systems Incorporated 4 Professional Drive, Suite 141 Gaithersburg, Maryland 20760 U.S.A.

(301) 840-0320 TWX 710-828-9617

#### INTERSATELLITE LINK CAPACITY REQUIREMENTS

#### SUMMARY

Interconnection of communications platforms by means of intersatellite links may be used in two categories of applications:

#### 1. Wide Platform Separation for Increased Coverage Area

An example for this application is the interconnection of a U.S. domestic platform with an Atlantic INTELSAT platform. An intersatellite link increases the coverage area for all earth stations accessing either platform with single hop operation. Transmission delay increases with platform separation as shown in Figure C-1.

#### 2. Small Platform Separation for Increased Systems Capacity

When a single platform does not provide adequate capacity for a given coverage area, two or more platforms may be deployed with small angular separations, e.g. U.S. domestic platforms with 4 degrees separation.

Typical requirements for intersatellite links for the two applications are derived in the analysis which follows, and are summarized below.

#### Case 1 Wide Platform Separation

A typical ratio for domestic to international traffic is 50 to 1. On this basis one would conclude that the intersatellite link connecting the U.S. domestic with an Atlantic INTELSAT platform would require a capacity equal to about 2 percent of the U.S. domestic system. However, this ratio would be modified by the following considerations:

- A large portion of the international traffic originates or terminates in the New York and Washington areas, and most of this traffic may not enter the domestic satellite system and therefore does not contribute to the intersatellite link requirements.
- The short haul portion of the U.S. domestic traffic may not be a candidate for satellite transmissions; thus the ratio of domestic satellite to international satellite traffic may be lower than 50 to 1.

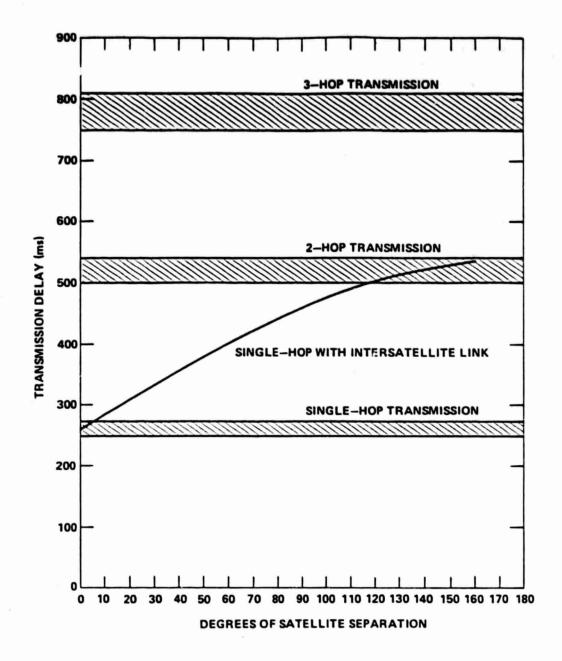


Figure C-1
TRANSMISSION DELAY

More precise evaluation of the intersatellite link requirements would require generation of a systems model with assumptions concerning the distribution of terrestrial versus satellite traffic both for the domestic and the international systems. With such assumptions made, the intersatellite link requirements can be determined from current traffic distributions in the INTELSAT traffic data base and current cable transmission plans.

In the absence of more detailed analysis, we recommend that intersatellite link capacities in the range of 2 to 10 percent of the platform capacity be assumed.

#### Case 2 Small Platform Separation

In a fully homogeneous system with two platforms of equal capacity, the intersatellite link would have to handle traffic equal to 50 percent of the individual platform capacity. If an attempt is made to segregate user communities on each platform, the intersatellite link requirements are reduced depending on specific traffic plan assumptions. Intersatellite link capacities of 10 to 20 percent will probably be adequate for most practical applications.

#### INTERSATELLITE LINK MODEL ANALYSIS

The FSI intersatellite link model contains equations to satisfy both homogenous and non-homogeneous satellite systems. The model will be applied to three particular systems:

U.S. to U.S. System
U.S. to Trans-Atlantic System
U.S. to South American System

For a satellite system to approach a homogeneous mix of traffic, it would almost have to consist of a single countries domestic traffic. Of these three examples only the U.S. to U.S. scenario would be of a homogeneous nature. In a homogeneous system there is an equal likelihood of any one customer calling any other customer; in such a case the following equation can be used.

 $A \times B = L$ 

where:

A - fraction of total traffic on satellite A

B - fraction of total traffic on satellite B

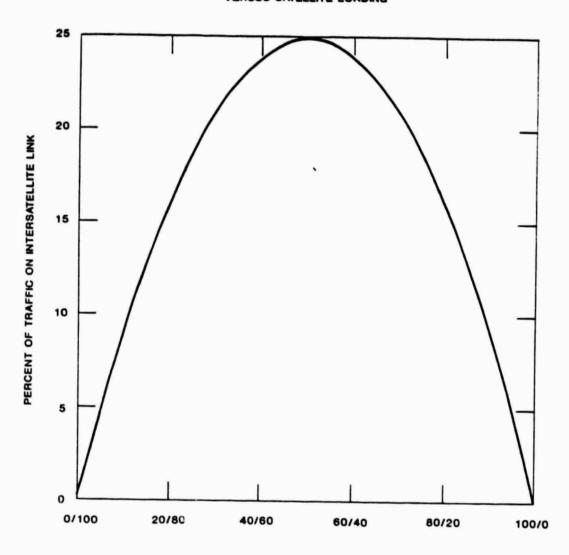
L - fraction of total traffic on intersatellite link

Figure C-2 shows how the percentage of traffic over the intersatellite link varies with different loadings of the two satellites. This figure shows that the maximum amount of traffic to be carried on the intersatellite link is 25 percent. This will occur only when both satellites are equally loaded.

A similar equation can be used for non-homogeneous traffic or traffic that is of the point-to-point type. This would be the case for main-office to branch-office communications. Since this type of user would not need to access all other possible users, a reduction in the amount of traffic carried over the intersatellite link would be realized.

FIGURE C-2

## PERCENT OF TRAFFIC ON INTERSATELLITE LINK VERSUS SATELLITE LOADING



SATELLITE LOADING (SATELLITE &/SATELLITE b)

The following equation takes into account the above mentioned private line services and the fact that their increased use will reduce the intersatellite link requirements.

 $A \times B \times (1-P) = L$ 

where:

A - fraction of traffic on satellite A

B - fraction of traffic on satellite B

P - fraction of traffic that is private line services

L - fraction of traffic on intersatellite link

This equation will now be applied to the low traffic scenario where this scenario consists of a single major path satellite interconnecting 20 high traffic cities and two platforms servicing the entire U.S. The two platforms would need to be interconnected by an intersatellite link so that multiple antennas would not be required at the earth stations. The necessary values for "A" and "B" are given in the system description along with the capacities of the platforms.

System Description: U.S. to U.S.

Two platforms, each with a maximum capacity of 1,092 transponders (Bandwidth = 36 MHz per transponder), will be configured as follows and use the frequencies given to attain this capacity.

Configuration:

39 spot beams covering CONUS bandwidth split three ways yielding 13 times frequency reuse

Frequency bands:

4/6 GHz

11/14 GHz

18/30 GHz

#### Capacity:

4/6 GHz = 12 transponders x 13 frequency reuse = 156 transponders

11/14 GHz = 12 transponders x 13 frequency reuse = 156 transponders

18/30 GHz = 60 transponders x 13 frequency reuse = 780 transponders

Platform Capacity 1,092

#### Percent of Traffic

Major path (pipeline satellite)	17.2
Platform A	49.7
Platform B	33.1
	100.0 %

The traffic percentages for Platforms A and B were developed as follows: The remaining satellite traffic, after the major path or pipeline satellite had its 17.2 percent, would be split 60/40 between the two platforms.

100% - 17.2% = 82.8% remaining traffic

For Platform A

82.8% x 60% = 49.7

For Platform B

82.8% x 40% = 33.1

In this non-homogenous case we need to use the second equation to calculate the intersatellite link requirement. A value for "P" must be chosen to represent a reasonable portion of the traffic that will not need to use the intersatellite link. In this scenario it is assumed that an effort will be made to assign common users to the same platform. For this reason the value 0.5 has been assigned to "P" yielding the following results:

 $.497 \times .321 \times (1 - .5) = 8.0\%$ 

The intersatellite link traffic will be 8.0 percent of the total U.S. traffic.

Up to now the discussion has revolved around the development of the theoretical technique for estimating the intersatellite link requirements; therefore, we consistantly referred to percentages of total traffic so that it would be easy to compare the requirements for different scenarios. The FSI traffic forecast for a system of this size deployed in the mid to late 1980's is 1,128 transponders. Going by the system description percentages given before the transponder requirements will be as follows:

	Number of Transponders
Major Path (pipeline satellite)	194
Platform A	561
Platform B	<u>373</u>
Total	1,128

The intersatellite link requirements will be

1,128 x 8.0% = 90 transponders

#### System Description U.S. to Trans-Oceanic and U.S. to South American Traffic

The following ratios have been used to develop this model for a U.S. to trans-oceanic satellite intersatellite link. These ratios have been derived from actual figures obtained from international and domestic carriers.

Ratio of domestic to international messages:

50.6 to 1

Ratio of total international to trans-oceanic messages:

1.4 to 1

Using these ratios and domestic traffic as 1,128, as given before, the trans-oceanic traffic can be calculated.

$$\frac{1,128}{50.5}$$
 = 22.3 transponders of international traffic

$$\frac{22.3}{1.4}$$
 = 15.9 transponders of trans-oceanic traffic

The remaining 6.4 transponders would be for communications with South America.

International Traffic = 
$$\frac{1,128}{36.5}$$
 = 30.9 transponders

Trans-Oceanic Traffic = 
$$\frac{30.9}{1.4}$$
 = 22.1 transponders

The remaining 8.8 transponders of traffic would be directed for South American communications with the United States.

APPENDIX D

LINK BUDGETS

#### PLATFORM COMMUNICATIONS PAYLOAD LINK BUDGETS

A major factor affecting the sizing and support requirements of the platform communications payloads or any payload requiring dedicated links to an earth segment is the integrity of the transmission link budgets. The primary parameters which determine transmission link integrity are EIRP (Effective Isotropic Radiated Power) and G/T (Ratio of Antenna Gain to Receive System Noise Temperature). Given the characteristics of the earth stations needed to interface with the platform payloads the link equations can be used to determine the payload EIRP and G/T parameters. These parameters must be such to compensate for link losses due to path attenuation, atmospheric loss, circuit loss, etc.

The link analyses for communications payloads Nos. 4 through 12 are contained in the COMSAT report on mission and payload requirements. The payload #3 link budget is provided in the Aerospace report on platform feasibility.

Direct to User Network & High Volume Trunking Link Budgets - Payloads for the Direct to User and High Volume Trunking Systems have been described and discussed in the Geostationary Platform Feasiblity Study by the Aerospace Corporation. To meet the expanded traffic requirements generated by Task 1 these payloads were extensively modified. The modifications increased payload capacity, introduced higher frequency bands, and had considerable impact on payload weight and power. To accommodate these modifications, the existing link budgets were revised and extended. The resulting DTU and HVT link budgets are based on the following assumptions:

- 1. All traffic on the links is digital with transmission at specified bit rates.
- Up and down links are isolated in the sense that the received messages
  are demodulated, regenerated, buffered, and switched, etc. onboard
  the platform. Processed messages are modulated on to downlink carriers.
- Each downlink carrier has its own high power amplifier or directly modulated power source, eliminating the need for back-off.
- Rain margins are provided where necessary and supplemented by site diversity for HVT services.

- Adaptive polarization techniques are used to compensate for the effects of atmospheric depolarization.
- 6. Link availability under atmospheric outage conditions will be:
  - a. DTU (14/12 GHz & 30/20 GHz) 99.5 percent
  - b. HVT (6/4 GHz w.h adaptive polarization) 99.99 percent
  - c. HVT (30/20 GHz with site diversity) 99.99 percent

Tables D-1 and D-2 show the up and down link budgets for the 14/12 GHz and 30/20 GHz DTU payloads.

Tables D-3 and D-4 show the up and down link budgets for the 6/4 GHz HVT payload using deplarization correction.

Tables D-5 and D-6 show the up and down link budgets for the  $30/20~\mathrm{GHz}$  HVT payload site diversity with 35 km separation.

Table D-7 summarizes the link margins.

## Table D-1. DTU Up-Links

Frequency	GHz	14.0	30.0
XMT Power	W/dBW	200/23	200/23
Feed Loss	dB	1.0	1.0
ET Antenna Size	Meters	7.0	7.0
Surface Tol.	Mil	20.0	20.0
ET Antenna Effic.		60.0	60.0
ET Antenna Gain (Axial)	dB	58.0	64.5
EIRP	dBW	80.0	86.5
Pointing Loss	dB	0.5	1.5
Availability		99.5	99.5
Total Attenuation	dB	2.1	9.8
Path Loss	dB	207.7	214.1
Revd Power	dBW	-130.3	-138.9
Sat. Ant. Diameter	Meters	6.0	4.0
Sat. Ant. Beamwidth	Degree	0.35	0.35
Sat. Ant. Efficiency		50.0	50.0
Sat. Ant. EOB Gain	dB	50.0	50.0
Noise Temperature	$^{\circ}K/dB$	1,000/30	1,000/30
G/T	$dB/^{\circ}K$	20.0	20.0
C/N <sub>O</sub> - up	dB/Hz	118.3	109.7
Polarization		Dual	Single
Depolarization - C/I	dB	32.0	
C/I - multibeam	dB	22.5	22.0
C/I - Total	dB	22.0	22.0
XPDR BW	$\mathrm{MHz}/\mathrm{dB}$	40/76	40/76
C/I <sub>o</sub> - Total	dB/Hz	98.0	98.0
$C/(N_0 + I_0)$	dB/Hz	98.0	97.7
Bit Rate	Mbs/dB	64.78.1	64.78.1
Modem Loss	dB	2.0	2.0
Available E <sub>b</sub> /N <sub>o</sub>	dB/Hz	17.9	17.6
Required E <sub>b</sub> /N <sub>o</sub>	dB/Hz	8.8	8.8
Margin - up	dB D-3	9.1	8.8

Table D-2. DTU Down-links

Eugeneneu	GHz	12.0	20.0
Frequency	W/dBW	2.0/3.0	5.0/7.0
XMT PWR	dB	2.0	3.0
Feed Loss		6.0	4.0
Sat. Ant. Diameter	Meters	0.35	0.35
Sat. Ant. Beamwidth	Degree		
Sat. Ant. Pointing	Degree	0.03	0.03
Sat. Ant. Efficiency		50.0	50.0
Sat. Ant. EOB Gain	dB	50.0	50.0
EIRP	dBW	51.0	<b>54.</b> 0
Pointing Loss	dB	0.2	0.2
Availability		99.5	99.5
Total Attenuation	dB	1.4	5.7
Path Loss	dB	206.6	210.5
Revd Power	dBW	-157.2	-162.4
ET Ant. Diameter	Meters	7.0	7.0
ET Ant. Efficiency		60.0	60.0
ET Ant. Axial Gain	dB	56.5	61.0
Noise Temperature	$^{\circ}k/dB$	225/23.5	400/26
G/T	dB/K	33.0	35.0
C -1 - down	dB/Hz	104.4	101.2
Polarization		Dual	Single
Depolarization C/I	dB	36.0	
C/I - multibeam	dB	22.0	22.0
C/I - Total	dB	21.8	22.0
C/I <sub>o</sub>	dB/Hz	97.8	98.0
$C/(N_Q + I_Q)$	dB/Hz	96.9	96.3
With Regeneration			
Available E <sub>b</sub> /N <sub>o</sub>	dB/Hz	16.8	16.2
Required E <sub>b</sub> /N	dB/Hz	8.8	8.8
Margin	dB	8.0	7.4

## Table D-3. HVT 6/4 GHz Uplink (With Depolarization Correction)

Frequency	Ghz	6.0
XMT Power	W/dBW	50/17
Feed Loss	dB	1.0
ET Antenna Size	Meters	12.0
Surface Tol.	Mil	20.0
ET Antenna Effic.		75.0
ET Antenna Gain (Axial)	dB	56.0
EIRP	dBW	72.0
Pointing Loss	dB	0.5
Availability		99.99
Total Attenuation	dB	5.5
Path Loss	dB	200.0
Revd Power	dBW	-134.0
Sat. Ant. Diameter	Meters	15.0
Sat. Ant. Beamwidth	Degree	0.35
Sat. Ant. Efficiency		50.0
Sat. Ant. EOB Gain	dB	50.0
Noise Temperature	$^{\circ} K/dB$	1,000/30
G/T	$dB/^{\circ}K$	20.0
$C/N_0$ - up	dB/Hz	114.6
Polarization		Dual
Depolarization - C/I	dB	22.0
C/I - multibeam	dB	24.0
C/I - Total	dB	19.9
XPDR BW	MHz/dB	160/82
C/I - Total	dB/Hz	101.9
$C/(N_0 + I_0)$	dB/Hz	101.7
Bit Rate	${ m Mbs/dB}$	256/84.1
Modem Loss	dB	2.0
Available E <sub>b</sub> /N	dB/Hz	15.6
Required E <sub>b</sub> /No	dB/Hz	11.1
Margin - up	dB D-5	4.5

## Table D-4. HVT 6/4 GHz Downlink (With Depolarization Correction)

Frequency	GHz	4.0
XMT PWR	W/dBW	1.0/0.0
Feed Loss	dΒ	2.0
Sat. Ant. Diameter	Meters	15.0
Sat. Ant. Beamwidth	Degree	0.35
Sat. Ant. Pointing	Degree	0.03
Sat. Ant. Efficiency		50.0
Sat. Ant. EOB Gain	dB	50.0
EIRP	dBW	48.0
Pointing Loss	dB	0.2
Availability		99.99
Total Attenuation	dB	1.0
Path Loss	dB	196.7
Rcvd Power	dBW	-149.7
ET Ant. Diameter	Meters	12.0
ET Ant. Efficiency		75.0
ET Ant. Axial Gain	dB	52.5
Noise Temperature	$^{\circ} K/dB$	214.8/23.3
G/T	dB/K	29.2
C/N <sub>o</sub> - down	dB/Hz	108.1
Polarization		Dual
Depolarization C/I	dB	22.0
C/I - multibeam	dB	24.0
C/I - Total	dB	19.9
C/I <sub>o</sub>	dB/Hz	101.9
$C/(N_0 + I_0)$	dB/Hz	101.0
With Regeneration		
Available E <sub>b</sub> /N <sub>o</sub>	dB/Hz	14.9
Required E /N	dB/Hz	11.1
Margin	dB	3.8

## Table D-5. HVT 30/20 GHz Uplink (With Site Diversity)

Frequency	Ghz	30.0
XMT Power	W/dBW	300/24.8
Feed Loss	dB	1.0
ET Antenna Size	Meters	12.0
Surface Tol.	Mil	< 20.0
ET Antenna Effic.		70.0
ET Antenna Gain (Axial)	dB	69.2
EIRP	dBW	93.0
Pointing Loss	dB	1.5
Availability		99.99
Total Attenuation	dB	20.0
Path Loss	dB	214.1
Rcvd Power	dBW	142.6
Sat. Ant. Diameter	Meters	4.0
Sat. Ant. Beam width	Degree	0.35
Sat. Ant. Efficiency		50.0
Sat. Ant. EOB Gain	dB	50.0
Noise Temperature	°K/dB	1,000/30
G/T	$dB/^{\circ}K$	20.0
C/N <sub>o</sub> - up	dB/Hz	106.0
Polarization		Dual
Depolarization - C/1 dB		22.0
C/I - multibeam	dB	24.0
C/I - Total	dB	19.9
XPDR BW	$\mathrm{MHz}/\mathrm{dB}$	200/83
C/I <sub>o</sub> - Total	dB/Hz	102.9
$C/(N_o + I_o)$	dB/Hz	100.9
Bit Rate	Mbs/dB	256/84.1
Modem Loss	dB	2.0
Available E <sub>b</sub> N <sub>o</sub>	dB/Hz	14.9
Required EbNo	dB/Hz	11.1
Margin - up	dB D-7	3.7

### Table D-6. HVT 30/20 GHz Downlink (With Site Diversity)

Frequency	GHz	20.0
XMT PWR	W/dBW	10.0/10/0
Feed Loss	dB	3.0
Sat. Ant. Diameter	Meters	4.0
Sat. Ant. Beamwidth	Degree	0.35
Sat. Ant. Pointing	Degree	0.03
Sat. Ant. Efficiency	*	50.00
Sat. Ant. EOB Gain	dB	50.0
EIRP	dBW	57.0
Pointing Loss	dB	0.2
Availability		99.99
Total Attenuation	dB	10.0
Path Loss	dB	210.5
Rcvd Power	dBW	-163.7
ET Ant. Diameter	Meters	12.0
ET Ant. Efficiency		70.0
ET Ant. Axial Gain	dB	66.0
Noise Temperature	$^{\circ}K/dB$	467/26.7
G/T	dB/K	39.3
C/N - down	${\rm d} B/{\rm H}z$	104.2
Polarization		Dual
Depolarization C/I	dB	22.0
C/I - multibeam	dB	24.0
C/I - Total	dB	19.9
СЛ	${\rm dB}/{\rm Hz}$	102.9
$C/(N_0 + I_0)$	${\tt dB/Hz}$	100.3
With Regeneration		
Available E <sub>b</sub> /N <sub>o</sub>	${\rm dB}/{\rm Hz}$	14.2
Required E <sub>b</sub> /N	${\rm d} B/{\rm H} z$	11.1
Margin	dB	3.1

Table D-7. Summary of Link Margins

Service	Frequency (GHz)	Marg Up	gins (dB) Down	Availability %
DTU	14/12	9.1	8.0	99.5
	30/20	8.8	7.4	99.5
HVT	6/4*	4.5	3.8	99.99
	30/20**	3.7	3.1	99.99

<sup>\*</sup>With Depolarization Correction

<sup>\*\*</sup>With Site Diversity

#### Link Budget Item Notes

- Total attenuation includes atmospheric and precipitation losses. It is assumed that rain-induced outages will occur 0.5% of the time for DTU traffic and 0.01% of the time for HVT traffic.
- Cross polarization interference can be aggravated by rain-induced depolarization
  of dual polarized beams. Cancellation techniques have been developed which substantially reduce the effect.
- 3. The multibeam C/I for a contiguous beam DTU system with a 3 segment frequency distribution is derived from a consideration of sidelobe interference into a central beam from surrounding rings of beams. A C/I of 22db assumes C/I contributions of 25 db from the first and second rings. This level of interference would be produced by first ring sidelobes of -33db and second ring sidelobes of -36db.

An HVT beam system with beams isolated into singles and groups experiences reduced interference due to the smaller number of interferers and can count on a C/I of 24do or better.

It should be noted that these C/I estimates assume worst case gaussian interference. Coherent sinusoidal interference could result in significantly greater C/I ratios.

4. The link performance requirements are given below. At all times a 3dB performance margin is the minimum acceptable.

Link Bit Error Rates				
Service	Total BER	Up/Down BER	Eb/No(db)	
DTU	$1 \times 10^{-4}$	$5 \times 10^{-5}$	8.8	
HVT	$1 \times 10^{-6}$	$5 \times 10^{-7}$	11.1	

APPENDIX E
PAYLOAD DATA SHEETS

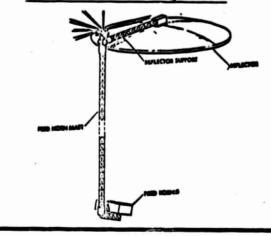
#### Candidate Payload Data Summary - Sheet 1

Date:	6/30/80	

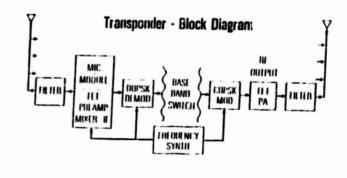
Code No:	COM 1.1	(WH/NTM)	)
Name: _	Direct to Use	r Networks	
Category	: Communica	ations	
Orbital I	ocation(s):	110° W	_

Description: Provides direct communication
between users at Ku Band frequencies via
roof-top antennas.

#### A. Antenna/Sensor Configuration



#### B. Transponder/Processor Configuration



- C. Antenna Sensor Data
- 1. No. TBD
- 2. Type: Offset fed parabolic reflector

- 9. / EOC Gain: \_\_\_\_\_\_ 50 dB EOC
- 10. Other:
- Size: 6 meter
   Coverage FCV: Western Hemisphere
   No. of Beam's Feeds: 260\*
   Pattern/Beamwidth: 0.35° per beam
   Max. Pointing Error: ± 0.03°
   Sensitivity (G T): 20 dB/K
- D. <u>Transponder/Processor Data</u>
- 1. No. 400 40 MHz Transponders
- 2. Type: Regenerative
- 3. Transmit Frequency: 12 GHz
- 4. Receive Frequency: 14 GHz
- 5. Bandwidth(s)/Data Rate(s): 40 MHz
- o. Transmit Power(s)/EIRP: 2 watts
- 7. Noise Figure/Temperature: 1000°K
- 8. Type of Access/Modulation: FDMA/TOMA
- 9. On-Board Switching: (M× N)  $400 \times 400$
- 10. Other:

<sup>\*</sup>See attachment for coverage pattern.

## Candidate Payload Data Summary - Sheet 2

Weight

(Kg)

100

Power

(W)

E. Weight/Power

Estimates

1. Antennas/Sensors

Date: 6/30/80 F. Support Requirements 6500 Sunlight/Eclipse Power: ss: \_ 5700 : \_ ± 0.1° ± 0.1° TBD TBD Yes No 10 yrs. 100% N) TBD TBD TBD siness, Institutions ate: \_\_\_ 1990

2.	Receivers:	450	200	2.	Sunlight/Eclipse, Heat Loss
3.	Transmitters:	200	1800	3.	Platform Attitude Control:
4.	Processors:	150	250	4.	Stationkeeping:
5.	Switch Matrix:	240	4000	5.	Thermal Control:
6.	Power Converters:	50	100	6.	Payload Volume:
7.	Cabling, Harness etc.	_50	150	7.	T, T&C/Avionics: TBD
s.	Totals:	1240	6500	9.	Mission Duration:
9.	Notes:			9.	Mission Duty Cycle:
				10.	Interconnect Switch: (M×N
				11.	Other:
_	<del></del>			-	
G.	Ground Segment			H.	Economic Data
1.	No. of Stations/User	s: 6000 plu	ıs	1.	Traffic Capacity:
2.	Antenna Size(s):	4.5/7.0 n	neter .	2.	Space Segment Cost:
3.	Beamwidth(s):			3.	Ground Segment Cost:
4.	Peak Gain(s):	58 dB		4.	Estimated Revenue/Yr:
5.	Noise Temperature:	225°K		5.	User Communities: Bus
6.	Receive Frequencie	12 GHz		6.	Technology Availability Da
7.	Transmit Frequenc	ies: 14 (	GHz	7.	Market Need Date: 1996
8.	Modulation/Access:	TDMA		8.	Other:
9.	Transmit Power:	200 watts			
10.	Other:				

### Candidate Payload Data Summary - Sheet 3

Date:	6/30/80

ı.	Payload Develo		J.
	Item	Calendar Year	
1.	Design .		
2.	Development		
3.	Fabrication		
4.	Integration	`	
5.	Test		

Supp	orting Research & Technology Needs
1.	Multi-beam antennas
2.	Large capacity digital matrix switch
3.	Solid state transmitters
4.	Low noise pre-amplifiers
5.	Large scale integration of microwave
	circuits.
6.	Optical path transmission & switching

### K. Special Requirements Constraints

- 1. Data also applies to DTU payload at 15 degrees W orbital location.
- 2. Payload capacity sized to meet requirements of the nominal traffic model.
- 3. Atlantic location coverage pattern TBD.

Payload #1.1

Date: 6/30/80

 No. of Beams

 Canada
 25

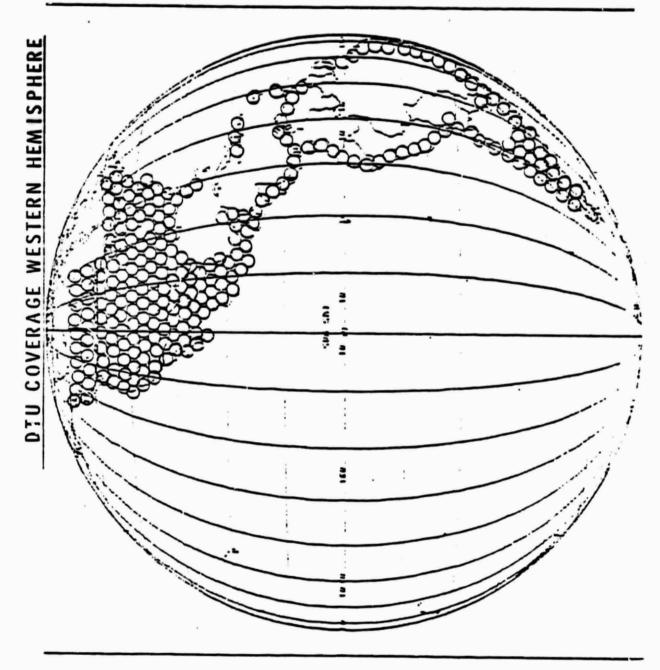
 U. S.
 120

 Mexico
 40

 Central Am
 15

 Bouth Am
 60

 Total
 260



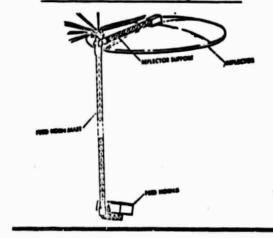
ORIGINAL PAGE IS OF POOR QUALITY

Date:	6/30/80	

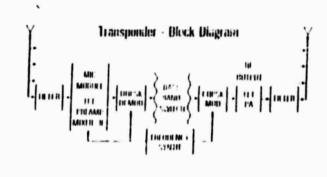
Code No:	COM	1.2 (WH/NT	'M)			
Name: Direct to User Networks						
Category: Communications						
Orbital Loc	ation(s):	110°W	_			

Description: Provides direct communications
between users at Ka Band frequencies via
roof-top antennas.

#### A. Antenna/Sensor Configuration



## B. Transponder/Processor Configuration



- C. Antenna Sensor Data
- 1. No. 3 reflectors
- Type: Offset fed
- 3. Size: 4 meters
- 4. Coverage FOV: Western Hemisphere
- 5. No. of Beams Feeds: 100\*
- 6. Pattern/Beamwidth: 0.35° per beam
- 7. Max. Pointing Error: ± 0.03°
- 8. Sensitivity (G/T): 20 dB/k
- 9. Peak/ EOC Gain: 50 dB EOC
- 10. Other:

- D. Transponder/Processor Data
- 1. No. 400
- 2. Type: Regenerative
- 3. Transmit Frequency: 20 GHz
- Receive Frequency: 30 GHz
- 5. Bandwidth(s)/Data Rate(s): 40 MHz
- 6. Transmit Power(s)/EIRP: 5 Watts
- Noise Figure/Temperature: 1000°K
- 8. Type of Access/Modulation: FDMA/TDMA
- 9. On-Board Switching:  $(M \times N) 400 \times 400$
- 10. Other:

\*Provides supplemental coverage of areas served by payload COM 1.1.

Date: 6/30/80

# Candidate Payload Dam Summary - Sheet 2

E.	Weight/Power Estimates	Weight (Kg)	Power (W)	F.	Support Requirements
1.	Antennas/Sensors	80.		1.	Sunlight/Eclipse Power: 11,500 Watts
2.	Receivers:	450	500	2.	Sunlight/Eclipse, Heat Loss: 9000 Watts
3.	Transmitters:	450	6000	3.	Platform Attitude Control: ± 0.1°
Ŧ.	Processors:	100	500	4.	Stationkeeping: ± 0.1°
5.	Switch Matrix:	240	4000	5.	Thermal Control: 0 - 40° C
6.	Power Converters:	50	300	6.	Payload Volume: TBD
7.	Cabling, Harness etc.	50	200	7.	T, T&C/Avionics: X Yes No
3.	Totals:	1420	11.500	8.	Mission Duration: 8 Yrs.
9.	Notes:			9.	Mission Duty Cycle: 100%
				10.	Interconnect Switch: (M×N) TBD
				11.	Other:
				1	
_				-	
G.	Ground Segment			H.	Economic Data
1.	No. of Stations/User	s:		1.	Traffic Capacity:
2.	Antenna Sizers : 4.	5/7.0 met	er	2.	Space Segment Cost: TBD
3.	Beamwidth(s):			3.	Ground Segment Cost:
4.	Peak Gain(s):			4.	Estimated Revenue/Yr:
5.	Noise Temperature:	400° K		5.	User Communities: Business Institutions
6.	Receive Frequencie	es: <u>20 G</u>	Hz	6.	Technology Availability Date: 1995
7.	Transmit Frequenc	ies: 30 G	Hz	7.	Market Need Date:2000
8.	Modulation/Access:				Other:
9.					
10.					
				1	

Date:	6/30/80	

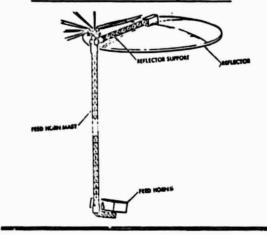
ı.	Payload Development Schedule		J.	Supporting Research & Technology Needs
	Item	Calendar Year		1. Multi-beam antennas
				2. High capacity digital matrix switch
1.	Design .			3. High efficiency TWTS
2.	Development			4. Low noise preamplifiers
3.	Fatrication			5. Large scale integration of microwave
4.	Integration			circuits
5.	Test			6. Optical path transmission and switchin

- 1. Data also applies to DTU payload at 15° W orbital location.
- 2. Payload capacity sized to meet requirements of the Nominal Traffic Model.
- 3. Atlantic location coverage pattern TBD.

Date:	6/30/80	

Code N	o:COM 2.1 -	- WH/NTM
Name:	Domestic, Regional	
Catego	ry: Communication	T runking ns
Orbital	Location(s): 1	10° W

#### A. Antenna/Sensor Configuration

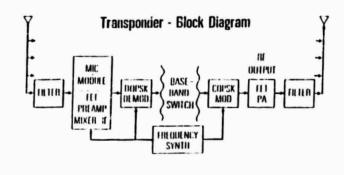


c.	Antenna/	Sensor	Data

- 1. No. 1
- 2. Type: Offset fed cassegrain dish
- 3. Size: 15 Meters
- 4. Coverage/FOV: Western Hemisphere
- 5. No. of Beams/Feeds: 65\*
- 6. Pattern/Beamwidth: 0.35° beams
- 7. Max. Pointing Error: ± 0.03°
- 8. Sensitivity (G/T): \_\_\_\_ 20 dB/K
- 9. Peak/EOC Gain: 50 dB peak
- 10. Other: \_\_\_\_\_

Provides high	rovides high volume com-			
for domestic,	regional and			
ental traffic.				
	for domestic,			

#### B. Transponder/Processor Configuration



<b>D</b>	Thomanandon	Descara	Data
D.	Transponder/	Processor	Data

- 1. No. \_\_\_\_125
- 2. Type: Regenerative
- 3. Transmit Frequency: 4 GHz
- 4. Receive Frequency: 6 GHz
- 5. Bandwidth(s)/Data Rate(s): \_\_\_\_160 MHz
- 6. Transmit Power(s)/EIRP: 1.0 Watts
- 7. Noise Figure/Temperature: 1000°K
- 8. Type of Access/Modulation: FDMA/TDMA
- 9. On-Board Switching: (M× N) 125 × 125
- 10. Other:\_\_\_\_

<sup>\*</sup>See attachment for coverage pattern.

Date: 6/30/80

	Weight/Power Estimates	Weight (Kg)	Power (W)	F.	Support Requirements
	Antennas/Sensors	100		1.	Sunlight/Eclipse Power: 700 Watts
	Receivers:	150	50	2.	Sunlight/Eclipse, Heat Loss: 550 Watts
	Transmitters:	80	300	3.	Platform Attitude Control: ± 0.1
	Processors:	50	50	4.	Stationkeeping: ± 0.1°
	Switch Matrix:	30	250	5.	Thermal Control: 0 - 40° C
	Power Converters:	20	30	6.	Payload Volume: TBD
	Cabling, Harness etc.	20	20		T, T&C/Avionics: X Yes No
	Totals:	450	700	§.	Mission Duration: 8 Yrs.
	Notes:			9.	Mission Duty Cycle: 100%
				1.0.	Interconnect Switch: (M×N) TBD
				11.	Other:
•	Ground Segment			н.	Economic Data
	No. of Stations/Users	: TBD		1.	Traffic Capacity:
	Antenna Sizeisi:	12 Me	eters	2.	Space Segment Cost: TBD
	Beamwidth(s):			3.	Ground Segment Cost: TBD
	Peak Gain(s):			4.	Estimated Revenue/Yr:
	Noise Temperature:			5.	User Communities: PTT Agencies
		s: 4 CH-		6.	Technology Availability Date: 1990
	Receive Frequencie	3. 4 GHZ			recumology Availability Date: 1990
				7.	
	Receive Frequencie Transmit Frequenci Modulation/Access:	es: 6 GHz		7. 8.	Market Need Date: 1990
	Transmit Frequenci	es: 6 GHz	1	7. 8.	

6/30/80

Date:

# Candidate Payload Data Summary - Sheet 3

	Payload Develop	oment Schedule  Calendar Year	J.	Supporting Research & Technology Needs  1. Multi-beam Antenna
				2. Large capacity digital matrix switch
ι.	Design			3. Solid state transmitters
2.	Development			4. Low noise preamplifiers
3.	Fabrication			5. Large scale integration of microwave
4.	Integration			circuits
5.	Test			6. Optical path transmission and switching

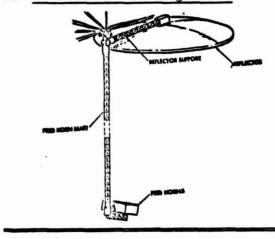
- 1. Data also applies to HVT payload at 15° W location.
- 2. Payload capacity sized to meet requirements of Nominal Traffic Model.
- 3. Atlantic coverage patterns TBD.

Date:	6/30/80	

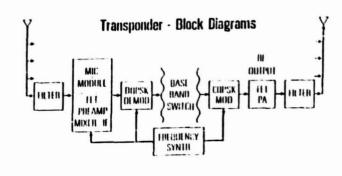
Code No:	COM 2	.2 - NTM
Name:	Domes	tic/Regional
Category:	Comm	unications
Orbital Loca	tion(s):	110° W

Description: Provides high volume communications for domestic and regional and intercontinental traffic.

#### A. Antenna/Sensor Configuration



## B. Transponder/Processor Configuration



- C. Antenna/Sensor Data
- 1. No. 1
- 2. Type: Offset fed reflector
- 3. Size: 6 Meters
- 4. Coverage/FOV: Western Hemisphere
- 5. No. of Beams/Feeds: 35\* approx.
- 6. Pattern/Beamwidth: 0.35° beams
- 7. Max. Pointing Error: ± 0.03°
- 8. Sensitivity (G/T): \_\_\_\_\_\_20 dB/K
- 9. Peak/EOC Gain: \_\_\_\_\_50 dB EOC
- 10. Other: \_\_\_\_

- D. <u>Transponder/Processor Data</u>
- 1. No. 100
- 2. Type: Regenerative
- 3. Transmit Frequency: 20 GHz
- 4. Receive Frequency: 30 GHz
- 5. Bandwidth(s)/Data Rate(s): 200 MHz
- 6. Transmit Power(s)/EIRP: 10 Watts
- 7. Noise Figure/Temperature: 1000°K
- 8. Type of Access/Modulation: FDMA/TDMA
- 9. On-Board Switching: (M× N) 100 × 100
- 10. Other: \_\_\_\_\_

\*See attachment for coverage pattern.

Date: 6/30/80

## Candidate Payload Data Summary - Sheet 2

E.	Weight/Power Estimates	Weight (Kg)	Power (W)	F.	Support Requirements
1.	Antennas/Sensors	30		1.	Sunlight/Eclipse Power: 3200
2.	Receivers:	100	100	2.	Sunlight/Eclipse, Heat Loss: 2200
3.	Transmitters:	140	2500	3.	Platform Attitude Control: ± 0.1°
4.	Processors:	40	100	4.	Stationkeeping: ± 0.1°
5.	Switch Matrix:	30	250	5.	Thermal Control: 0 - 40° C
6.	Power Converters:	_20	150	6.	Payload Volume: TBD
7.	Cabling, Harness etc.	20	100	7.	T, T&C/Avionics: X Yes No
8.	Totals:	380	3200	3.	Mission Duration: 8 Yrs.
9.	Notes:			9.	Mission Duty Cycle: . 100%
				10.	Interconnect Switch: (M×N) TBD
				11.	Other:
=				-	
G.	Ground Segment			н.	Economic Data
1.	No. of Stations/User	<u>s:</u>		1.	Traffic Capacity:
2.	Antenna Size(s):	12 Mete	ers	2.	Space Segment Cost:TBD
3.	Beamwidth(s):			3.	Ground Segment Cost:
4.	Peak Gain(s):	69 dB		4.	Estimated Revenue/Yr:
5.	Noise Temperature:	478°K		5.	User Communities: PTT Agencies
6.	Receive Frequenci	es: 20 G	Hz	6.	Technology Availability Date: 1990
7.	Transmit Frequen	cies: 30 C	GHz	7.	Market Need Date: 1990
8.	Modulation/Access:	TDMA		8.	Other:
9.		7.00			
10.					

6/30/80

Date:

# Candidate Payload Data Summary - Sheet 3

_					
ı.	Payload Develop	ment Schedule	Ј.	Supp	orting Research & Technology Needs
	Item	Calendar Year		1.	Multi-beam Antenna
				2.	Satellite Switch
1.	Design _			3.	Multi-level TWTs
2.	Development			4.	Low Noise Preamplifiers
э.	Fabrication			5.	Large scale integration of microwave
4.	Integration				circuits
5.	Test-			6.	Optical path transmission & switching

- 1. Data also applies to HVT payload at 15° W orbital location.
- 2. Payload capacity sized to meet requirements of the Nominal Traffic Model.
- 3. Atlantic Region coverage patterns TBD.

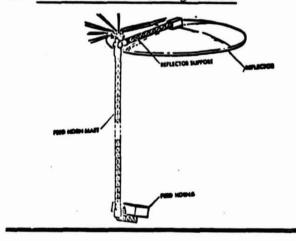
Date:	6-30-80	

Code No:	1.1 - HTM		
Name:	Direct-to-User Networks		
Category:	Communications		

Category: \_\_\_\_Communications \_\_\_\_\_root-top antennas.

Orbital Location(s): \_\_\_\_110° W \_\_\_\_\_\_

#### A. Antenna/Sensor Configuration

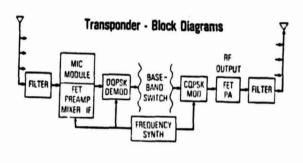


- C. Antenna/Sensor Data
- 1. No. 2
- 2. Type: <u>Citset fed reflector</u>
- 3. Size: 20 Meters
- 4. Coverage/FOV: Western Hemisphere
- 5. No. of Beams/Feeds: \_\_\_TBD
- 6. Pattern/Beamwidth: 0.1° per beam
- 7. Max. Pointing Error: 0.01°
- 8. Sensitivity (G/T): 30 dB/°K
- 9. Peak/EOC Gain: 60 dB EOC
- 10. Other: \_\_\_\_\_

#### B. Transponder/Processor Configuration

Description: Provides direct communication

between users at Ku Band frequencies via



- D. Transponder/Processor Data
- No. 500 40 MHz transponders
- 2. Type: Regenerative
- 3. Transmit Frequency: \_\_\_12 GHz
- 4. Receive Frequency: 14 GHz
- 5. Bandwidth(s)/Data Rate(s): 40 MHz
- 6. Transmit Power(s)/EIRP: 2 Watts
- 7. Noise Figure/Temperature: 1000°K
- 8. Type of Access/Modulation: FDM A/TDM A
- 9. On-Board Switching: (M× N) 500 × 500
- 10. Other:

Date:	6/30/80

				_	
E.	Weight/Power Estimates	Weight (Kg)	Power (W)	F.	Support Requirements
1.	Antennas/Sensors	200		1.	Sunlight/Eclipse Power: 6500
2.	Receivers:	300	200	2.	Sunlight/Eclipse, Heat Loss: 5700
3.	Transmitters:	450	2800	3.	Platform Attitude Control: ± 0.1°
4.	Processors:	150	150	4.	Stationkeeping: ± 0.1°
5.	Switch Matrix:	240	4000	5.	Thermal Control:TBD
6.	Power Converters:	50	100	6.	Payload Volume: TBD
7.	Cabling, Harness etc.	50	150	7.	T, T&C/Avionics: Yes No
8.	Totals:	1440	7500	8.	Mission Duration: 10 Years
9.	Notes:			9.	Mission Duty Cycle:100%
				10.	Interconnect Switch: (M×N) TBD
			,	11.	Other:
==				-	
G.	Ground Segment			н.	Economic Data
1.	No. of Stations/Users	s: <u> </u>		1.	Traffic Capacity:
2.	Antenna Size(s):	4.5/7.0 M	eters	2.	Space Segment Cost:
3.	Beamwidth(s):			3.	Ground Segment Cost:
4.	Peak Gain(s):	58 dB		4.	Estimated Revenue/Yr:
5.	Noise Temperature:	225°K		5.	User Communities: Business Institutions
6.	Receive Frequencie	s: <u>12</u>	GHz	6.	Technology Availability Date: 1995
7.	Transmit Frequence	ies: 14	GHz	7.	Market Need Date:1995
8.	Modulation/Access:	TDMA		8.	Other:
9.	Transmit Power:	200 W	Vatts		
١٥.	Other:				

Date:	6/30/80

ı.	Payload Developme	nt Schedule	J. <u>St</u>	Supporting Research & Technology Needs
	Item	Calendar Year	1.	Large multi-beam antennas
			2.	Large digital matrix switch
1.	Design		3.	Solid state transmitters
2.	Development		4.	Low noise preamplifiers
3.	Fabrication		5.	Large scale integration of microwave
4.	Integration		1 _	circuits
5.	Test		6.	Optical path transmission & switching
	_			

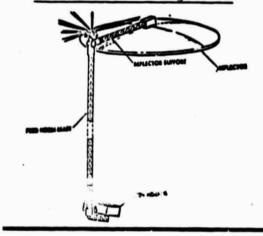
- This payload has been designed to provide a capacity of 1000 equivalent 40 MHz transponders.
- Two payloads of this capacity are needed to meet the requirements of the High Traffic Model at the Western Hemisphere orbital location (110° W).
- 3. One payload of this capacity is needed to meet the requirements of the High Traffic Model at the Atlantic orbital location (15° W).
- 4. Antenna coverage patterns are TBD.

Date: \_\_\_\_\_6/30/80

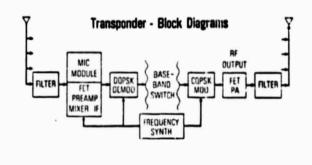
Code No: _	1.2 - HTM
Name:	Direct-to-User Networks
Category:	Communications
Orbital Lo	cation(s). 110° W

Description: Provides direct communication
between users at Ka Band frequencies via
roof-top antennas.

A. Antenna/Sensor Configuration



B.	Trans	onder/	Processor	Configuration



c.	Antenna/Sensor Data
1.	No. 2
2.	Type: Offset fed reflector
3.	Size: 10 Meters
4.	Coverage/FOV: Western Hemisphere
5.	No. of Beams/Feeds:TBD
6.	Pattern/Beamwidth: 0.1° per beam
7.	Max. Pointing Error: 0.01°
8.	Sensitivity (G/T): 30 dB/°K
9.	Peak/FOC Gain: 60 dB EOC

Other:

10.

D. Transponder/Processor Data 500 No. 1. Type: Regenerative 2. 3. Transmit Frequency: \_\_\_\_ 20 GHz Receive Frequency: \_\_\_\_ 30 GHz 4. 5. Bandwidth(s)/Data Rate(s): 40 MHz Transmit Power(s)/EIRP: 5 Watts 7. Noise Figure/Temperature: 1000°K 8. Type of Access/Modulation: FDMA/TDMA On-Board Switching: (M× N) 500 × 500 9.

10.

Other:

Date: 6/30/80

E.	Weight/Power Estimates	Weight (Kg)	Power (W)	F.	Support Requirements
1.	Antennas/Sensors	100		1.	Sunlight/Eclipse Power:14,000
2.	Receivers:	450	1,000	2.	Sunlight/Eclipse, Heat Loss: 11,500
3.	Transmitters:	450	8,000	3.	Platform Attitude Control: ± 0.1°
4.	Processors:	100	500	4.	Stationkeeping: ± 0.1°
5.	Switch Matrix:	240	4,000	5.	Thermal Control: 0 - 40° C
6.	Power Converters:	50	300	6.	Payload Volume: TBD
7.	Cabling, Harness etc.	50	200	7.	T, T&C/Avionics: X Yes No
8.	Totals:	1,440	14,000	8.	Mission Duration: 8 Years
9.	Notes:			9.	Mission Duty Cycle:100%
				10.	Interconnect Switch: (M×N) TBD
				11.	Other:
_				_	
G.	Ground Segment			н.	Economic Data
1.	No. of Stations/Users:			1.	Traffic Capacity:
2.	Antenna Size(s): 4.5/7.0 Meters			2.	Space Segment Cost:
3.	Beamwidth(s):			3.	Ground Segment Cost:
4.	Peak Gain(s):			4.	Estimated Revenue/Yr:
5.	Noise Temperature:	400°K		5.	User Communities: Business Institutions
6.	Receive Frequencie	s: 20 C	GHz	6.	Technology Availability Date: 1995
7.	Transmit Frequence	ies: 30	GHz	7.	Market Need Date: 2000
8.	Modulation/Access:	TDMA		8.	Other:
9.					
١٥.					
	-				

Date: 6/30/80

4. Low noise premplifiers

1.	. Payload Development Schedule		J. Supporting Research & Technology Needs		
	Item	Calendar Year	1. Multi-beam antennas		
			2. High capacity matrix switch		
1.	Design		3. Solid state transmitters		

- 3. Fabrication 5. Large scale integration of microwave 4. Integration circuits
- 5. Test 6. Optical path transmission and switching

## K. Special Requirements/Constraints

2. Development

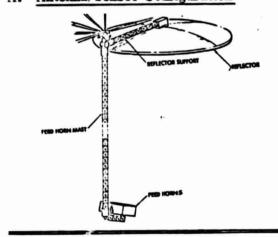
- 1. This payload has been designed to provide a capacity of 1000 equivalent  $40~\mathrm{MHz}$  transponders.
- 2. Two payloads of this capacity are needed to meet the requirements of the High Traffic Model at the Western Hemisphere orbital location.
- 3. One payload of this capacity is needed to meet the requirements of the High Traffic Model at the Atlantic orbital location.
- 4. Antenna coverage patterns are TBD.

Date: 6/30/80

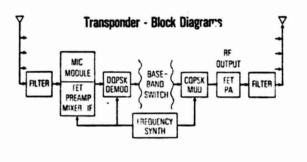
Code No	c:COM 2.1-HTM	
Name:	Domestic, Regional & Transoce	an
Categor	Trunking :y: Communications	
Orbital	Location(s): 110°W -	

Description: Provides high volume communications for dome stic, regional and intercontinental traffic.

# A. Antenna/Sensor Configuration



## B. Transponder/Processor Configuration



c.	ntenna/Sensor Data			
	No	1.		
2.	Type:	Offset-fed r	eflector	
3.	Size:	60 meters		
4.	Coverag	ge/FOV:		
5.	No. of	Beams/Feeds:	TBD	
6.	Pattern	/Beamwidth:	0.1° per beam	
7.	Max. P	ointing Error:	0.01°	
8.	Sensitiv	rity (G/T):	30 dB/°K	
9.	Peak/	OC Gain:	60 dB EOC	

Other:

10.

D.	Transponder/Processor Data
1.	No125
2.	Type: Regenerative
3.	Transmit Frequency: 4 GHz
4.	Receive Frequency: 6 GHz
5.	Bandwidth(s)/Data Rate(s): 160 MHz
6.	Transmit Power(s)/EIRP: 1.0 Watts
7.	Noise Figure/Temperature: 1000°K
8.	Type of Access/Modulation: FDMA/tdma
9.	On-Board Switching: (M× N) 125 × 125
0	Ottor

Date: \_\_\_\_\_6/30/80

E.	Weight/Power Estimates	Weight (Kg)	Power (W)	F.	Support Requirements	
1.	Antennas/Sensors	500	-	1.	Sunlight/Eclipse Power:	1200
2.	Receivers:	150	100	2.	Sunlight/Eclipse, Heat Loss:	1050
3.	Transmitters:	80	500	3.	Platform Attitude Control:	± 0.1°
4.	Processors:	50	100	4.	Stationkeeping:	± 0.1°
5.	Switch Matrix:	30	400	5.	Thermal Control:	0 - 40℃
6.	Power Converters:	20	50	6.	Payload Volume:	TBD
7.	Cabling, Harness etc.	20	50	7.	T, T&C/Avionics: Y	es No
8.	Totals:	850	1200	8.	Mission Duration:	8 Years
9.	Notes:			9.	Mission Duty Cycle:	
				10.	Interconnect Switch: (M×N)	
	·			11.	Other:	
				l		
_				_		
G.	Ground Segment			н.	Economic Data	
1.	No. of Stations/Users	: -		1.	Traffic Capacity:	
2.	Antenna Size(s):	12 meters		2.	Space Segment Cost:	
3.	Beamwidth(s):	-		3.	Ground Segment Cost:	
4.	Peak Gain(s):	56 dB		4.	Estimated Revenue/Yr:	
5.	Noise Temperature: _	214°K		5.	User Communities: PT	T Agencies
6.	Receive Frequencie	s: 4 GHz		6.	Technology Availability Date	: 1990
7.	Transmit Frequenci	es: 6 GHz		7.	Market Need Date: 1990	
8.	Modulation/Access:	TDMA		8.	Other:	
9.	Transmit Power-	50 Watts				
10.	Other:					
		-				

Date:	6/30/80

I. Payload Development Schedule

		ment benedute
	Item	Calendar Year
1.	Design	
2.	Deve or ent	
3.	Fabr . tion	
4.	Integration	
5.	Test	

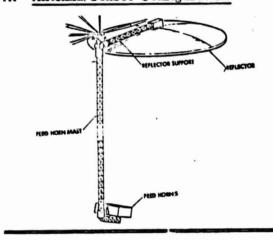
- J. Supporting Research & Technology Needs
  - Multibeam Antenna
  - 2. Large Capacity Matrix Switch
  - 3. Solid State Transmitters
  - 4. Low Noise Preamplifiers
  - 5. Large Scale Integration of Microwave
    Circuits
  - 6. Optical Path Transmission & Switching

- 1. Data also applies to HVT payload at 15 W location.
- 2. Payload capacity sized to meet requirements of the High Traffic Model.
- 3. Coverage patterns TBD.

Date:	6/30/80

Code N	o: <u>COM-2.</u>	2-HTM	
Name:		gional & Transocean	
Categor	Trunking ry: Com	munications	
Orbital Location(s):		110°	

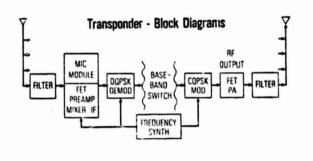
# A. Antenna/Sensor Configuration



c.	Antenna/Sensor Data	
1.	No. 1	
2.	Type: Offset fed re	Nector
3.	Size: 10 meters	
4.	Coverage/FOV: West	tern Hemisphere
5.	No. of Beams/Feeds:	
6.	Pattern/Beamwidth: _	0.1° per beam
7.	Max. Pointing Error:	0.01°
8.	Sensitivity (G/T):	30 dB/K
9.	Peak/EOC Gain:	60 dB EOC
10	Othor	

Description:	Provides high volume communi-						
cations for	domestic,	regional an	d inter-				
continental	traffic.						

# B. Transponder/Processor Configuration



D.	Transponder/Processor Data
1.	No100
2.	Type: Regenerative
3.	Transmit Frequency: 20 GHz
4.	Receive Frequency: 30 GHz
5.	Bandwidth(s)/Data Rate(s): 200 MHz
6.	Transmit Power(s)/EIRP: 10 Watts
7.	Noise Figure/Temperature: 1000°K
8.	Type of Access/Modulation: TDMA
9.	On-Board Switching: (M× N) 100 × 100

10.

Other:

Date:			

E.	Weight/Power Estimates	Weight (Kg)	Power (W)	F.	Support Requirements
1.	Antennas/Sensors	100		١.	Sunlight/Eclipse Power: 4000
2.	Receivers:	100	100	2.	Sunlight/Eclipse, Heat Loss:3000
3.	Transmitters:	140	3000	3.	Platform Attitude Control: ± 0.1°
4.	Processors:	40	100	4.	Stationkeeping: ± 0.1°
5.	Switch Matrix:	30	400	5.	Thermal Control: 0-40°C
6.	Power Converters:	20	300	6.	Payload Volume:
7.	Cabling, Harness etc.	20	100	7.	T, T&C/Avionics: X Yes No
8.	Totals:	450	4000	8.	Mission Duration: 8 Years
9.	Notes:			9.	Mission Duty Cycle:100%
				10.	Interconnect Switch: (M×N) TBD
				11.	Other:
-	-			_	
G.	Ground Segment			н.	Economic Data
1.	No. of Stations/Users	: -		1.	Traffic Capacity:
2.	Antenna Size(s):	12 mete	rs	2.	Space Segment Cost:
3.	Beamwidth(s):			3.	Ground Segment Cost:
4.	Peak Gain(s):	69 dB		4.	Estimated Revenue/Yr:
5.	Noise Temperature:	478°K		5.	User Communities: PTT Agencies
6.	Receive Frequencie	s: _20 GH	z	6.	Technology Availability Date: 1990
7.	Iransmit Frequence	ies: 30 GH	z	7.	Market Need Date:1990
8.	Modulation/Access:	TDMA		8.	Other:
9.	_				
10.	Other:				
			_		
				1	

Date:	6/30/80	

I.	Payioad	Develo	pment	Schedul
			P	

Item	Calendar Year
Design	
Development	
Fabrication	
Integration	
Test	
	Design Development Fabrication Integration

#### J. Supporting Research & Technology Needs

- 1. Multibeam Antenna
- 2. High Capacity Matrix Switch
- 3. Solid State Transmitters
- 4. Low Noise Preamplifiers
- 5. Large Scale Integration of Microwave
  Circuits
- 6. Optical Path Transmission & Switching

- 1. Data also applies to HVT payload at 15°W location.
- 2. Payload capacity sized to meet requirements of the High Traffic Model.
- 3. Coverage Patterns TBD.

Payload # 3

#### Candidate Payload Data Summary - Sheet 1

Date: 3-14-80

Code No: COM 3 - WH

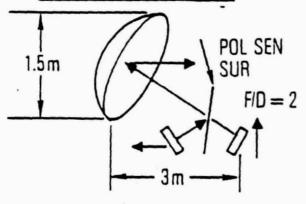
Name: TV Distribution

Category: Communications

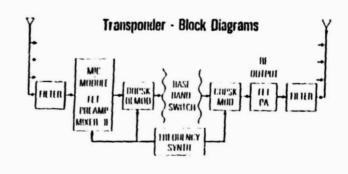
Orbital Location(s): 110° W

Description: Provides TV program distribution for Network Broadcasts, CATV and other video transmissions

#### A. Antenna/Sensor Configuration



#### B. Transponder/Processor Configuration



- C. Antenna/Sensor Data

  1. No. 2
- 2. Type: Offset-fed reflector
- 3. .Siże: 1.5 meters
- Coverage/FOV: North/South America
- 5. No. of Beams/Feeds: 65
- 6. Pattern/Beamwidth: 1.0°
- 7. Max. Pointing Error: ± 6 1°
- 8. Sensitivity (G/T): 10 DbK
- 9. Peak/EOC Gain: 40 dB EOC
- 10. Other: \_\_\_\_\_

- D. Transponder/Processor Data
- 1. No. \_\_\_\_\_75
- 2. Type: Regenerative Repeater
- 3. Transmit Frequency: 12.2-12.7 GH,
- 4. Receive Frequency: 17.1 17.6 GHz
- 5. Bandwidth(s)/Data Rate(s): 40 MHz
- 6. Transmit Power(s)/EIRP: 10W/53 dBW
- 7. Noise Figure/Temperature: 1000°K
- 8. Type of Access/Modulation: QPSK/SSTDMA
- 9. On-Board Switching: (M× N) 50 x 50
- 10. Other:

Date: 3-14-80

E.	Weight/Power Estimates	Weight (Kg)	Power (W)	F.	Support Requirements
1.	Antennas/Sensors	20		1.	Sunlight/Eclipse Power: 4000 Watts
2.	Receivers:	50	200	2.	Sun ight/Eclipse, Heat Loss: 3250 Watts
3.	Transmitters:	300	3200	3.	Platform Attitude Control: ± 0.5°
4.	Processors:	25	200	4.	Stationkeeping: ±0.1°
5.	Switch Matrix:	5	50	5.	Thermal Control: 0 - 40° C
6.	Power Converters:	10	200	6.	Payload Volume:TBD
7.	Cabling, Harness etc.	10	150	7.	T, T&C/Avionics: X Yes No
8.	Totals:	400	4000	8.	Mission Duration: 8 Years
9.	Notes:			9.	Mission Duty Cycle: 100%
				10.	Interconnect Switch: (M×N) TBD
				11.	Other:
	v.				
_				_	
G.	Ground Segment			H.	Economic Data
1.	No. of Stations/User	s: <u>-</u>		1.	Traffic Capacity: 1600 channels
2.	Antenna Size(s):	4.5	meters	2.	Space Segment Cost:
3.	Beamwidth(s):	0.5°		3.	Ground Segment Cost:
4.	Peak Gain(s):			4.	Estimated Revenue/Yr:
5.	Noise Temperature:	220° K		5.	User Communities: Networks, CATY
6.	Receive Frequencie	12.2	- 12.7 GH <sub>z</sub>	6.	Technology Availability Date: 1985
7.	Iransmit Frequenc			7.	Market Need Date: 1987
8.	Modulation/Access:			8.	Other:
9.	Transmit Power:				
10.					

Candidate	Payload	Data	Summary	-	Sheet	3

Ca	Candidate Payload Data Summary - Sheet 3			Date: 3/14/80
	Payload Develop	ment Schedule Calendar Year	J.	Supporting Research & Technology Needs  1. Multi-beam Antenna
				2. Digital Matrix Switch
ι.	Design			3. Solid State Transmitters
2.	Development			4. Low Noise Preamplifiers
3.	Fabrication			
ı.	Integration			
5.	Test			
			l	

## K. Special Requirements/Constraints

1. Data also applied to payload at 15°W location. Antenna coverage patterns TBD.

## Payload # 4

Candidate	Payload	Data	Summary	-	Sheet 1
	_				

Date: 3-18-80

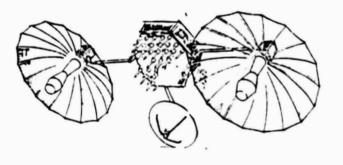
Code No: _	COM 4 - WH
Name:	Tracking & Data Relay
Category:	Communications
Orbital Lo	cation(s): 15° W & 110°W

Description: \_ This payload relays data from low orbit and other satellites to a central earth station in CONUS.

# A. Antenna/Sensor Configuration

See also Attachment #1

B. Transponder/Processor Configuration



See Attachment #2

C.	Antenna/Sensor Data
1.	No. 4
2.	Type: Centerfed reflectors/Phased array
3.	Size: 5m (2) 2m (1), Array (50 elements)
4.	Coverage/FOV: Spot and area
5.	No. of Beams/Feeds: 4
6.	Pattern/Beamwidth:
7.	Max. Pointing Error: ± 0.5°
8.	Sensitivity (G/T): $21/27$ (K), $-6/12$ (S) dB/H
9.	Peak/EOC Gain:
10	Other

D.	Transponder/Processor Data
1.	No. 4
2.	Type: Processing
3.	Transmit Frequency: 13.7 & 2.1 GHz
4.	Receive Frequency: 14.7 & 15 GHz
5.	Bandwidth(s)/Data Rate(s): 50 MH <sub>z</sub> (K)
6.	Transmit Power(s)/EIRP: 1.6/30(K), 26/30 (S)
7.	Noise Figure/Temperature:
8.	Type of Access/Modulation: <u>FDMA/TDM</u> A
9.	On-Board Switching: (M× N) TBD
10.	Other:

Date: 3-18-80

E.	Weight/Power Weight/Power (K		ower (W)	F.	Support Requirements	
1.	Antennas/Sensors 9	)		1.	Sunlight/Eclipse Power:	680 Watts
2.	Receivers: 8	) 1	.50	2.	Sunlight/Eclipso. Heat Loss	: 620 Watts
3.	Transmitters: 7	) 2	00	3.	Platform Attitude Control:	± 0.1°
4.	Processors: 4	0 1	50	4.	Stationkeeping:	NA
5.	Switch Matrix:			5.	Thermal Control:	
6.	Power Converters: 2	) 1	00	6.	Payload Volume:	
7.	Cabling, Harness etc3	)	80	7.	T, T&C/Avicaies: X	
8.	Totals:3	30 6	80	8.	Mission Duration:	
9.	Notes:			9.	Mission Duty Cycle:	
				10.	Interconnect Switch: (M×N)	
				11.	Other:	
					4	
G.	Ground Segment			H.	Economic Data	
1.	No. of Stations/Users:	1		1.	Traffic Capacity:	
2.	Antenna Size(s):	18 meter		2.	Space Segment Cost:	
3.	Beamwidth(s):0	.1°		3.	Ground Segment Cost:	
4.	Peak Gain(s):	64 dB		4.	Estimated Revenue/Yr:	
5.	Noise Temperature: 450	° K		5.	User Communities: NA	
6.	Receive Frequencies:	13.7 GH <sub>Z</sub>		6.	Technology Availability Date	
7.	Transmit Frequencies:_	14.7 GH <sub>Z</sub>		7.		
8.	Modulation/Access: FI	MA/TDM	A	8.	Other:	
9.	Transmit Power: 5.0	Watts				
10.	Other: See Section K for l	ow orbit s	atellite			
			_			

Candidate	Pay	vload	Data	Summary	-	Sheet 3	,
			-				_

Car	ndidate Payload Da	ata Summary - Sheet 3		Date:
I.	Payload Develop	ment Schedule Calendar Year	J.	Supporting Research & Technology Needs N/A
1.	Design			
2.	Development			
3.	Fabrication			
4.	Integration			
5.	Test			

#### K. Special Requirements/Constraints

1. This mission is based on the current TDR requirements. It includes both fixed (phased array) and moving (center fed) antennas to track one or multiple low-orbit satellites. Up- and down-links are in the NASA S and K bands.

If relay via a distant Geostationary Platform is needed (thus providing global coverage without "blind spots"), it is via another service (ISL) link.

2. Low orbit satellite terminal.

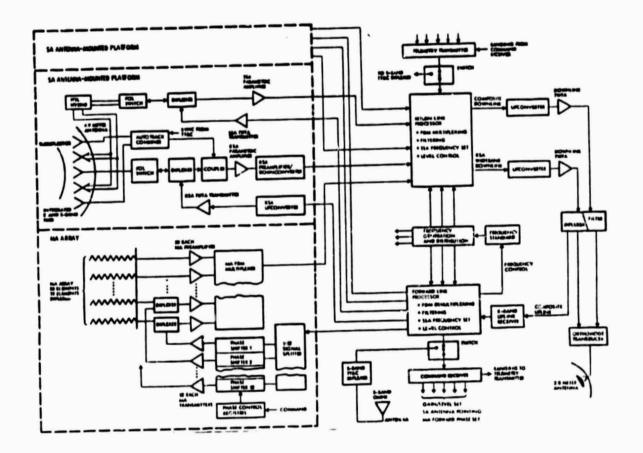
Antenna: -1.5 meter dish

Transmit Frequency: 2.25, 2.2875 & 15.0034 GHz Receive Frequency: 2.05, 2.10G41 & 13.775 GHz Bandwidth: 50 kHz, 12 MHz & 25 MHz

System Noise Temperature: 450°K

Modulation/Multiple Access: SCPC/TDMA

3. Data also applies to payload at 15°W orbital location.



TDRSS Communication Subsystem Simplified Block Diagram

8. Sensitivity (G/T): \_\_\_\_\_17 dB/K

9. Peak/EOC Gain: \_\_\_\_\_30 dB

10. Other: \_\_\_\_

Candidate Payload Data Summary - Sheet 1 3-24-80 Date: Code No: COM 5 - WH Description: Provides access to learning Name: Educational Television resource centers by remote schools, colleges Category: Communications and other interested groups Orbital Location(s): \_\_\_\_\_ 110° W\_\_ See also Attachment 1. A. Antenna/Sensor Configuration B. Transponder/Processor Configuration C. Antenna/Sensor Data D. Transponder/Processor Data No. \_\_\_\_16 1. 1. Type: Fixed Offset fed reflectors Type: Translating 2. Size: 3.0m (4) & 1.5m (4) 3. Transmit Frequency: 2.5 GH, Coverage/FOV: No. America/So. America Receive Frequency: 14 GHz No. of Beams/Feeds: 8 Bandwidth(s)/Data Rate(s): 35 MHz 5. 5. Pattern/Beamwidth: 3.5°/5.5° 6. Transmit Power(s)/EIRP: 6W/36 dBW Noise Figure/Temperature: 100°K Max. Pointing Error: ± 0.1° 7.

8.

9.

10.

Type of Access/Modulation: FM/SCPT

On-Board Switching: (M× N) NA

Other:

Date: March 24, 1980

E.	Weight/Power Estimates	Weight (Kg)	Power (W)	F.	Support Requirements	
1.	Antennas/Sensors	55		1.	Sunlight/Eclipse Power:	400/0
2.	Receivers:	50	50	2.	Sunlight/Eclipse, Heat Loss:	300/0
3.	Transmitters:	350	320	3.	Platform Attitude Control:	± 0.1°
4.	Processors:	-		4.	Stationkeeping:	± 0.1°
5.	Switch Matrix:			5.	Thermal Control:	0 to 40° C.
6.	Power Converters:	25	30	6.	Payload Volume:	
7.	Cabling, Harness etc.			7.	T, T&C/Avionics: X Ye	s No
8.	Totals:	480	400	8.	Mission Duration:	10 Years
9.	Notes:			9.	Mission Duty Cycle: Off	
				10.	Interconnect Switch: (M×N)	N/A
				-0.	mich comicer owner. (112-11)	
				11.	Other:	
 G.	Ground Segment Tra			11. —	Other:	
1.	No. of Stations/Users	ı: <u>-</u>		11. Н.	Economic Data Traffic Capacity: 32	Channels
1. 2.	No. of Stations/Users	5 m (3 m)		H. 1. 2.	Economic Data Traffic Capacity: 32 Space Segment Cost:	Channels -
1. 2. 3.	No. of Stations/Users Antenna Size(s):  Beamwidth(s): 1°	5 m (3 m) - (3°)		H. 1. 2.	Economic Data Traffic Capacity: 32 Space Segment Cost: Ground Segment Cost:	Channels -
1. 2. 3.	No. of Stations/Users Antenna Size(s):  Beamwidth(s):  1°  Peak Gain(s):  55	5 m (3 m) - (3°) db (35 db	)	H. 1. 2. 3. 4.	Economic Data Traffic Capacity: 32 Space Segment Cost: Ground Segment Cost: Estimated Revenue/Yr:	Channels -
1. 2. 3. 4.	No. of Stations/Users Antenna Size(s):  Beamwidth(s):  Peak Gain(s):  55  Noise Temperature:	5 m (3 m) - (3°) db (35 db) (100° K)	)	H. 1. 2. 3. 4. 5.	Economic Data Traffic Capacity: 32 Space Segment Cost: Ground Segment Cost: Estimated Revenue/Yr: User Communities: Educa	Channels  tional Institutio
1. 2. 3. 4. 5.	No. of Stations/Users Antenna Size(s):  Beamwidth(s):  Peak Gain(s):  Noise Temperature:  Receive Frequencie	5 m (3 m) - (3°) db (35 db) (100° K) s: (2.5 G	) GH <sub>Z</sub> )	H. 1. 2. 3. 4. 5.	Economic Data Traffic Capacity: 32 Space Segment Cost: Ground Segment Cost: Estimated Revenue/Yr: User Communities: Educa Technology Availability Date:	Channels tional Institutio
1. 2. 3. 4.	No. of Stations/Users Antenna Size(s):  Beamwidth(s):  Peak Gain(s):  Noise Temperature:  Receive Frequencie  Transmit Frequence	5 m (3 m) - (3°) db (35 db) (100° K) s: (2.5 G)	) GH <sub>Z</sub> )	11. H. 1. 2. 3. 4. 5. 6. 7.	Economic Data Traffic Capacity: 32 Space Segment Cost: Ground Segment Cost: Estimated Revenue/Yr: User Communities: Educa Technology Availability Date: Market Need Date:	Channels  tional Institutio  Now  1980
1. 2. 3. 4. 5.	No. of Stations/Users Antenna Size(s):  Beamwidth(s):  Peak Gain(s):  Noise Temperature:  Receive Frequencie  Transmit Frequence  Modulation/Access:	5 m (3 m) - (3°) db (35 db) (100° K) s: (2.5 G) ies: 14 GF	GH <sub>Z</sub> )	H. 1. 2. 3. 4. 5.	Economic Data Traffic Capacity: 32 Space Segment Cost: Ground Segment Cost: Estimated Revenue/Yr: User Communities: Educa Technology Availability Date: Market Need Date:	Channels  tional Institutio  Now  1980
1. 2. 3. 4. 5. 6.	No. of Stations/Users Antenna Size(s):  Beamwidth(s):  Peak Gain(s):  Noise Temperature:  Receive Frequencie  Transmit Frequence	5 m (3 m) - (3°) db (35 db) (100° K) s: (2.5 G) ies: 14 GF	GH <sub>Z</sub> )	11. H. 1. 2. 3. 4. 5. 6. 7.	Economic Data Traffic Capacity: 32 Space Segment Cost: Ground Segment Cost: Estimated Revenue/Yr: User Communities: Educa Technology Availability Date: Market Need Date:	Channels  tional Institutio  Now  1980

Candidate	Pa	yload	Data	Summary	-	Sheet	3

Candidate Payload Data Summary - Sheet 3	Date: 3-24-80
I. Payload Development Schedule  Item Calendar Year	J. Supporting Research & Technology Needs  N/A
1. Design 2. Development 3. Fabrication 4. Integration 5. Test	

- 1. Time zone down-link beams are used in the USA, Canada and Mexico. Regional spot beams are used in South and Central America. These missions may be turned off during Eclipse.
- 2. Data also applies to payload at 15°W orbital location.

On-Board Switching: (M× N) N.A.

Other: \_\_\_\_\_

# Candidate Payload Data Summary - Sheet 1

8.

9.

10.

Peak/EOC Gain: 30 dB EOC

Other:

Candidate Payload Data Summary - Sheet 1	Date: July 24, 1979				
Code No:COM_6 - WH  Name:Direct to Home TV  Category:Communications  Orbital Location(s):110° W	Description: Relays color TV programs directly to the home owner.				
Crotar Escation(s).	See also Attachment #1				
A. Antenna/Sensor Configuration	B. Transponder/Processor Configuration				
C. Antenna/Sensor Data	D. Transponder/Processor Data				
1. No. 2	1. No. 8				
2. Type: Centerfed reflectors	2. Type: Frequency Translating				
3. Size: 1.5 m (Ku) & 10 m (UHF)	3. Transmit Frequency: 700 MHz				
4. Coverage/FOV: Regional	4. Receive Frequency: 14.25 GHz				
5. No. of Beams/Feeds: 4	5. Bandwidth(s)/Data Rate(s): 40 MH <sub>2</sub>				
6. Pattern/Beamwidth: 3° x 4° (UHF)	6. Transmit Power(s)/EIRP: 100W/51.3 dBW				
7. Max. Pointing Error: ± 0.1°	7. Noise Figure/Temperature: 379° K				
8. Sensitivity (G/T): 18.5 dB/K	8. Type of Access/Modulation: TV/FM				

9.

10.

Date: 3-25-80

Ε.	Weight/Power Estimates	Weight (Kg)	Power (W)	F.	Support Requirements
1.	Antennas/Sensors	40		1.	Sunlight/Eclipse Power: 2100/250
2.	Receivers:	20	100	2.	Sunlight/Eclipse, Heat Loss: 1600/250
3.	Transmitters:	290	1850	3.	Platform Attitude Control: ± 0.1°
4.	Processors:		-	4.	Stationkeeping: ± 0,1°
5.	Switch Matrix:			5.	Thermal Control: 0 to 40° C
6.	Power Converters:	30	100	6.	Payload Volume: TBD
7.	Cabling, Harness etc.	20	50	7.	T, T&C/Avionics: X Yes No
8.	Totals:	400	2100	8.	Mission Duration: 10 yrs.
9.	Notes:			9.	Mission Duty Cycle: Not during eclipse
				10.	Interconnect Switch: (M×N) N.A.
				11.	Other:
-				_	
G.	Ground Segment	Receive (T	ransmit)	н.	Economic Data
1.	No. of Stations/User	s:		1.	Traffic Capacity: 8 channels
2.	Antenna Size(s): 2	2.5 m (4.5	m)	2.	Space Segment Cost:
3.	Beamwidth(s):1	.0° (0.5°	')	3.	Ground Segment Cost:
4.	Peak Gain(s):2	5 dB (50 d	B)	4.	Estimated Revenue/Yr:
5.	Noise Temperature:	1000° K		5.	User Communities: Govt., Pay TV, Movie Cos
6.	Receive Frequencie	s: 700 M	H <sub>z</sub>	6.	Technology Availability Date: Now
7.	Transmit Frequenc	ies: (14.2	5 GH <sub>z</sub> )	7.	Market Need Date: 1987
8.	Modulation/Access:	TV/FM_		8.	Other:
9.	Transmit Power:	(15 W)			
10.	Other:				

Ca	ndidate Payload D	ata Summary - Sheet 3		Date: July 24, 1979
ı.	Payload Develop	oment Schedule	J.	Supporting Research & Technology Needs
	Item	Calendar Year		
1.	Design			
2.	Development			
3.	Fabrication			
4.	Integration			
5.	Test			
			Ì	

- 1. During eclipse it may be possible to turn off transmitters to reduce DC power storage needs.
- 2. Data also applies to payload at 15°W orbital location.

### Payload #7

March 27, 1980

Code No: COM 7 - WH	Description: Provides corumunications an
Name: Mobile Air	navigation to/from commercial aircraft.

A. Antenna/Sensor Configuration

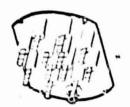
Category: Communications

Orbital Location(s): \_\_\_\_

C. Antenna/Sensor Data

9.

10.



Candidate Payload Data Summary - Sheet 1

B. Transponder Processor Configuration

Date:

	No. 2	
	Type: 12 Helix array	& horn
	Size: One met	ter
	Coverage/FOV:	Global
	No. of Beams/Feeds:	2
	Pattern/Beamwidth: E	arth coverage
,	Max. Pointing Error: ±	0.1°

EOC Gain: 16.4 dB (L), -15.5 dB (C)

Other:

D. Transponder/Processor Data No. 1. Type: Translating 2. Transmit Frequency: 1.6, (5.88 GHz) 3. 4. Receive Frequency: 1.5, (5.125 GHz) 5. Bandwidth(s)/Data Rate(s): 80 kHz (0.4 MHz) Transmit Power(s)/EIRP: 100W(L), 10W(C) 7. Noise Figure/Temperature: 354° K Sensitivity (G/T) = 11.3 (L), -16.5 (C) dB/K 8. Type of Access/Modulation: SCPC PM 9. On-Board Switching: (M× N) N.A. Other:\_\_\_\_ 10.

## Payload # 7

# Candidate Payload Data Summary - Sheet 2

Date: \_\_March 27, 1980

Ε.	Weight/Power Estimates	Weight (Kg)	Power (W)	F.	Support Requirements		
١.	Antennas/Sensors	50		1.	Sunlight/Eclipse Power: 1200 Watts		
2.	Receivers:	20	100	2.	Sunlight/Eclipse, Heat Loss: 800		
3.	Transmitters:	110	1000	3.	Platform Attitude Control:		
ŧ.	Processors:			4.	Stationkeeping: N.A.		
5.	Switch Matrix:			5.	Thermal Control: 0 to 40° C		
6.	Power Converters:	5	50	6.	Payload Volume: TBD		
7.	Cabling, Harness etc.	5	50	7.	T, T&C/Avionics: X Yes No		
8.	Totals:	200	1200	8.	Mission Duration: 8 Yrs.		
9.	Notes:			9.	Mission Duty Cycle: 100%		
				10.	Interconnect Switch: (M×N) TBD		
				11.	Other:		
				=	·		
G.	Ground Segment Land (A/C)				Economic Data		
1.	No. of Stations/Users:				Traffic Capacity:		
2.	Antenna Size(s): 7 meter (0.8 meter)			2.	Space Segment Cost:		
3.	Beamwidth(s): 0.5° (17°)			3.	Ground Segment Cost:		
4.	Peak Gain(s): 48 dB (20 dB)			4.	Estimated Revenue/Yr:		
5.	Noise Temperature: 194 (354)°K			5.	User Communities: Airlines & Gov't.		
6.	Receive Frequencies: 5.125 (1.5) GHZ			6.	Technology Availability Date: Now		
7.	Transmit Frequencies: 5.88 (1.6) GHz				Market Need Date: 1985		
8.	Modulation/Access: SCPC/PM				Other:		
9.	Transmit Power:	50W (220W	1)				
10.	Other:						

Candidate Payload Data Summary - Sheet 3				Date: March 27, 1980
_				
ı.	Payload Develop	ment Schedule	J.	Supporting Research & Technology Needs
	Item	Calendar Year		
1.	Design			
2.	Development			
3.	Fabrication			
4.	Integration			
5.	Test			

### K. Special Requirements/Constraints

- Links to and from commercial aircraft are provided at 1.6/1.5 GHz in internationally allocated aeronautical mobile satellite bands. At the platform the signals are converted to the 5 GHz band for connection to air traffic control and navigation centers.
- 2. Data also applies to payload at 15°W orbital location.

## Candidate Payload Data Summary - Sheet 1

\*Shared with air mobile service

Date: March 27, 1980

Code No: COM 8 - WH	Description: Provides communications			
Name: Sea Mobile	between ships and shore stations. Can be linke			
Category: Communications	to terrestrial network.			
Orbital Location(s):15W				
	See also Attachment #1			
A. Antenna/Sensor Configuration	B. Transponder/Processor Configuration			
C. Antenna/Sensor Data	D. Transponder/Processor Data			
1. No. 2	1. No. 4			
2. Type: Reflector, 12 helix array*	2. Type: Processing Repeater			
3. Size: 14 meter, 1 meter	3. Transmit Frequency: 1.6 GHz			
4. Coverage/FOV: Spot & Global	4. Receive Frequency: 1.5 GHz			
5. No. of Beams/Feeds:4	5. Bandwidth(s)/Data Rate(s): 5 MHz			
6. Pattern/Beamwidth: 1° & 19°	6. Transmit Power(s): 2W, 60W			
7. Max. Pointing Error: ± 0.1°	7. Noise Figure/Temperature: 1000 K			
8. Sensitivity (G/T): $10 \text{ dB/}^{\circ}\text{K}$ , -17 dB/ $^{\circ}\text{K}(L)$	8. Type of Access/Modulation: SCPC/PM			
9. EOC Gain: 41 dB, 15 dB (L)	9. On-Board Switching: (M× N) N.A.			
10. Other:	10. Other:			

Candidate Fayload Data Summary - Sheet 3				Date: March 27, 1980
ı.	Payload Develop	ment Schedule Calendar Year	J.	Supporting Research & Technology Needs
1.	Design			
2.	Development			
3.	Fabrication			
4.	Integration			
5.	Test			

### K. Special Requirements/Constraints

- 1. Links to and from commercial aircraft are provided at 1.6/1.5 GHz in internationally allocated aeronautical mobile satellite bands. At the platform the signals are converted to the 5 GHz band for connection to air traffic control and navigation centers.
- 2. Data also applies to payload at 15°W orbital location.

\*Shared with air mobile service

Date: March 27, 1980

Code No: COM 8 - WH	Description: Provides communications
Name: Sea Mobile	between ships and shore stations. Can be linked
Category: Communications	to terrestrial network.
Orbital Location(s): 15W	
	See also Attachment #1
A. Antenna/Sensor Configuration	B. Transponder/Processor Configuration
C. Antenna/Sensor Data	D. Transponder/Processor Data
1. No. 2	1. No. 4
2. Type: Reflector, 12 helix array*	2. Type: Processing Repeater
3. Size: 14 meter, 1 meter	3. Transmit Frequency: 1.6 GHz
4. Coverage/FOV: Spot & Global	4. Receive Frequency: 1.5 GHz
5. No. of Beams/Feeds: 4	5. Bandwidth(s)/Data Rate(s): 5 MH <sub>2</sub>
6. Pattern/Beamwidth: 1° & 19°	6. Transmit Power(s): 2W, 60W
7. Max. Pointing Error: ± 0.1°	7. Noise Figure/Temperature: 1000 K
8. Sensitivity (G/T): 10 dB/°K, -17 dB/°K(I	8. Type of Access/Modulation: SCPC/PM
9. EOC Gain: 41 dB, 15 dB (L)	9. On-Board Switching: (M× N) N.A.
10. Cther:	10. Other:

Date: March 27, 1980

E.	Weight/Power Estimates	Weight (Kg)	Power (W)	F.	Support Requirements
1.	Antennas/Sensors	300	-	1.	Sunlight/Eclipse Power: 600
2.	Receivers:	10	80	2.	Sunlight/Eclipse, Heat Loss: 460W
3.	Transmitters:	50	400	3.	Platform Attitude Control: ± 0.1°
4.	Processors:		50	4.	Stationkeeping: N.A.
5.	Switch Matrix:			5.	Thermal Control: TBD 'C to TBD 'C
6.	Power Converters:	20	50	6.	Payload Volume: TBD
7.	Cabling, Harness etc.	20	20	7.	T, T&C/Avionics: X Yes No
8.	Totals:	400	600	8.	Mission Diration: TBD
Э.	Notes:			9.	Mission Duty Cycle:100%
				10.	Interconnect Switch: (M×N) TBD
				1	
				11.	Other:
G.	Ground Segment			11. H.	Other:  Economic Data
	Ground Segment No. of Stations/Users	s: 1000 +		-	
١.				н.	Economic Data Traffic Capacity: 100 channels
ı. 2.	No. of Stations/Users	1.2 meters		н.	Economic Data Traffic Capacity: 100 channels Space Segment Cost:
1. 2. 3.	No. of Stations/Users Antenna Size(s):	1.2 meters		H. 1. 2.	Economic Data Traffic Capacity: 100 channels
1. 2. 3.	No. of Stations/Users Antenna Size(s): Beamwidth(s):	1.2 meters 10° 23.5 dB		H. 1. 2. 3.	Economic Data Traffic Capacity: 100 channels Space Segment Cost: Ground Segment Cost:
G. 1. 2. 3. 4.	No. of Stations/Users Antenna Size(s):  Beamwidth(s):  Peak Gain(s):	1.2 meters 10° 23.5 dB 500° K		H. 1. 2. 3. 4.	Economic Data Traffic Capacity: 100 channels Space Segment Cost: Ground Segment Cost: Estimated Revenue/Yr:
1. 2. 3. 4.	No. of Stations/Users Antenna Size(s):  Beamwidth(s):  Peak Gain(s):  Noise Temperature:	1.2 meters 10° 23.5 dB 500° K s: 1.5 GB	H <sub>2</sub>	H. 1. 2. 3. 4. 5. 6.	Economic Data Traffic Capacity: 100 channels Space Segment Cost: Ground Segment Cost: Estimated Revenue/Yr: User Communities: All shipping
1. 2. 3. 4. 5.	No. of Stations/Users Antenna Size(s):  Beamwidth(s):  Peak Gain(s):  Noise Temperature:  Receive Frequencie	1.2 meters 10° 23.5 dB 500° K s: 1.5 GH	H <sub>z</sub>	H. 1. 2. 3. 4. 5. 6.	Economic Data Traffic Capacity: 100 channels Space Segment Cost: Ground Segment Cost: Estimated Revenue/Yr: User Communities: All shipping Technology Availability Date: Now Market Need Date: 1985
1. 2. 3. 4. 5.	No. of Stations/Users Antenna Size(s):  Beamwidth(s):  Peak Gain(s):  Noise Temperature:  Receive Frequencie  Transmit Frequencie	1.2 meters 10° 23.5 dB 500° K s: 1.5 GB tes: 1.6 G	H <sub>z</sub>	H. 1. 2. 3. 4. 5. 6.	Economic Data Traffic Capacity: 100 channels Space Segment Cost: Ground Segment Cost: Estimated Revenue/Yr: User Communities: All shipping Technology Availability Date: Now

Ca	ndidate Payload D	ata Summary - Sheet 3 .		Date: March 27. 1 80
т.	Payload Develop	ment Schedule Calendar Year	J.	Supporting Research & Technology Needs
1.	Design			
2.	Development			
3.	Fabrication			
4.	Integration			
5.	Test			

## K. Special Requirements/Constraints

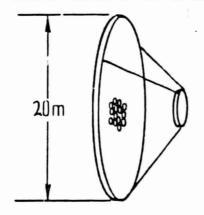
Shore station links are carried by the point to point communication payload via an interconnect link with the sea mobile payload.

Date: 3-31-80

Code No:	COM 9 - NTM
Name:	Land Mobile
Category:	Communications
Orbital Location	s): 110°W

Description: Payload provides substantially increased and improved communication services to mobile users.

A. Antenna/Sensor Configuration



C. Antenna Sensor Data

B. Transponder/Processor Configuration

1.	No1
2.	Type: MBA - cassegrain dish
3.	Size: 20 meters
4.	Coverage/FOV: Regional
5.	No. of Beams Feeds: 30
6.	Pattern/Beamwidth: 1.0°
7.	Max. Pointing Error: ±0.1°
8.	Sensitivity (G T): 16 dB/°K
9.	EOC Gain: 40 dB
10	Other:

Transponder/Processor Data D. No. 30 1. 2. Type: On-board switching Transmit Frequency: 881-902 MHz 3. Receive Frequency: 928-947 MHz 4. 5. Bandwidth(s)/Data Rate(s): 30 KHz/channel Transmit Power(s)/EIRP: 40 watts Noise Figure/Temperature: 750°K 7. 8. Type of Access/Modulation: FM/FDMA 9. On-Board Switching: TBD Other: 20 channels per transponder 10.

Date: 3-31-80

Ε.	Weight/Power Estimates	Weight (Kg)	Power (W)	F.	Support Requirements
ι.	Antennas/Sensors	300		1.	Sunlight/Eclipse Power: 4000
2.	Receivers:	50	100	2.	Sunlight/Eclipse, Heat Loss: 2800
3.	Transmitters:	120	3600	3.	Platform Attitude Control: ±0.1°
4.	Processors:	_		4.	Stationkeeping: NA
5.	Switch Matrix:	-	_	5.	Thermal Control: 0-40°C
6.	Power Converters:	30	200	6.	Payload Volume:TBD
7.	Cabling, Harness etc.	30	100	7.	T, T&C/Avionics: Yes No
8.	Totals:	530	4000	8.	Mission Duration: 8 yrs
9.	Notes:		•	9.	Mission Duty Cycle:100%
				10.	Interconnect Switch: (M×N) TBD
				11.	Other:
-				_	
G.	Ground Segment			н.	Economic Data
1.	No. of Stations/Users	s: 8000 pl	us	1.	Traffic Capacity: 600 channel/beam
2.	Antenna Size(s):	0.5 me	ter	2.	Space Segment Cost: \$25M
3.	Beamwidth(s):	50°		3.	Ground Segment Cost:
4.	Peak Gain(s):	10dB		4.	Estimated Revenue/Yr:
5.	Noise Temperature:			5.	User Communities: Govt. & Commercial
6.	Receive Frequencie			6.	Technology Availability Date: 1990
7.		Transmit Frequencies: 928-947 MHz			Market Need Date: Now
	Modulation/Access: SCPC/FDMA			7. 8.	Other:
8.					<u> </u>
9.	Transmit Power:				
10.	Other:				
				1	

Date:	3-31-80

-				
Ι.	Payload Develop	Calendar Year	J.	Supporting Research & Technology Needs  1. Large multi-beam antenna.
1.	Design			
2.	Development			
3.	Fabrication			
4.	Integration			
5.	Test			

### K. Special Requirements/Constraints

- Small, simple earth stations are placed on moving or transportable objects on the earth's surface. Voice and low-speed data services may be provided. Navigation information is obtained by relaying an Omega receiver raw output to a remote computer for decoding and ambiguity resolution. The return link provides the location.
- 2. A cluster of beams is used to subdivide the country (CONUS) for frequency reuse. Beams of 1° are used to synthesize a (CONUS) 48-state coverage. In South America, 1° spot beams illuminate populated areas or bush areas of special interest (e.g., oil exploration or mineral extraction). There are 20 beams in the U.S. and 10 in South America.
- 3. Data also applies to payload at 15°W location. Atlantic region coverage patterns TBD.
- 4. High traffic model version of this payload would incorporate a 60 meter diameter antenna with  $0.5^{\circ}$  footprints.

Date: 3-31-80

### Candidate Payload Data Summary - Sheet 1

Code No: COM 10	Description: Provides transoceanic and			
Name: Intercontinental Trunking *	intercontinental communications to link			
Category:Communications	domestic and regional areas of common inter			
Orbital Location(s): 15°W				
A. Antenna/Sensor Configuration	B. Transponder/Processor Configuration			
C. Antenna/Sensor Data	D. Transponder/Processor Data			
1. No.	1. No			
2. Type:	2. Type:			
3. Size:	3. Transmit Frequency:			
4. Coverage/FOV:	4. Receive Frequency:			
5. No. of Beams/Feeds:	5. Bandwidth(s)/Data Rate(s):			
6. Psttern/Beamwidth:	6. Transmit Power(s)/EIRP:			
7. Max. Pointing Error:	7. Noise Figure/Temperature:			
8. Sensitivity (G/T):	8. Type of Access/Modulation:			
9. Peak/EOC Gain:	9. On-Board Switching: M× N)			

\*Functions incorporated in Payloads 2.1 and 2.2

Other:

10.

10.

Other:

Date: March 28, 1980

Code No: COM 11	Description: Provides direct platform to
Name: Inter-Satellite Links	platform links.
Category: Communications	
Orbital Location(s): 15°W & 110°W	
	See also attachment #1
A. Antenna/Sensor Configuration	B. Transponder/Processor Configuration
C. Antenna/Sensor Data	D. Transponder/Processor Data
1. No. 2 per link	1. No. 2
2. Type: Center fed reflectors	2. Type: Processing
3. Size: 3 meters	3. Transmit Frequency: _55 GHz
4. Coverage/FOV:	4. Receive Frequency: 62 GHz
5. No. of Beams/Feeds: 2	5. Bandwidth(s)/Data Rate(s): 1 GHz
6. Pattern/Beamwidth: 0.3	6. Transmit Power(s)/EIRP: 65 watts
7. Max. Pointing Error: ±0.03°	7. Noise Figure/Temperature:
8. Sensitivity (G/T): 33 dB/K	8. Type of Access/Modulation:
9. Peak/EOC Gain: 60 dB EOC	9. On-Board Switching: (M× N)
10. Other:	10. Other:

Date: March 28, 1980

	Weight/Power Estimates	Weight (Kg)	Power (W)	F.	Support Requirements
	Antennas/Sensors	40		1.	Sunlight/Eclipse Power: 300 watts
	Receivers:	10	10	2.	Sunlight/Eclipse, Heat Loss: 230 watts
	Transmitters:	40	250	3.	Platform Attitude Control: ±0.1°
	Processors:			4.	Stationkeeping: ±0.1°
	Switch Matrix:			5.	Thermal Control: 0 to 40°C
	Power Converters:	5	20	6.	Payload Volume: TBD
	Cabling, Harness etc.	5	20	7.	T, T&C/Avionics:/ Yes No
	Totals:	100	300	8.	Mission Duration: 8 yrs
	Notes:			9.	Mission Duty Cycle:100%
				10.	Interconnect Switch: (M×N) TBD
				11.	Other:
·-		ot applicab		н.	Economic Data
	No. of Stations/Users	:		H. 1.	Economic Data Traffic Capacity:
	No. of Stations/Users Antenna Size(s):	:		H. 1. 2.	Economic Data Traffic Capacity: Space Segment Cost:
	No. of Stations/Users Antenna Size(s):  Beamwidth(s):	:		H. 1. 2.	Economic Data Traffic Capacity: Space Segment Cost: Ground Segment Cost:
	No. of Stations/Users Antenna Size(s):  Beamwidth(s):  Peak Gain(s):	:		H. 1. 2. 3. 4.	Economic Data Traffic Capacity: Space Segment Cost: Ground Segment Cost: Estimated Revenue/Yr:
	No. of Stations/Users Antenna Size(s):  Beamwidth(s):  Peak Gain(s):  Noise Temperature:	:		H. 1. 2. 3. 4. 5.	Economic Data Traffic Capacity: Space Segment Cost: Ground Segment Cost: Estimated Revenue/Yr: User Communities: Platform Payloads
	No. of Stations/Users Antenna Size(s):  Beamwidth(s):  Peak Gain(s):  Noise Temperature:  Receive Frequencie	s:		H. 1. 2. 3. 4. 5.	Economic Data Traffic Capacity: Space Segment Cost: Ground Segment Cost: Estimated Revenue/Yr: User Communities: Platform Payloads Technology Availability Date: 1985
	No. of Stations/Users Antenna Size(s):  Beamwidth(s):  Peak Gain(s):  Noise Temperature:  Receive Frequencie  Transmit Frequencie	s: 		H. 1. 2. 3. 4. 5. 6.	Economic Data Traffic Capacity: Space Segment Cost: Ground Segment Cost: Estimated Revenue/Yr: User Communities: Platform Payloads Technology Availability Date: 1985 Market Need Date: 1990
	No. of Stations/Users Antenna Size(s):  Beamwidth(s):  Peak Gain(s):  Noise Temperature:  Receive Frequencie Transmit Frequencie Modulation/Access:	s:		H. 1. 2. 3. 4. 5. 6.	Economic Data Traffic Capacity: Space Segment Cost: Ground Segment Cost: Estimated Revenue/Yr: User Communities: Platform Payloads Technology Availability Date: 1985
	No. of Stations/Users Antenna Size(s):  Beamwidth(s):  Peak Gain(s):  Noise Temperature:  Receive Frequencie  Transmit Frequencie	s: 		H. 1. 2. 3. 4. 5. 6.	Economic Data Traffic Capacity: Space Segment Cost: Ground Segment Cost: Estimated Revenue/Yr: User Communities: Platform Payloads Technology Availability Date: 1985 Market Need Date: 1990

Date: March 28, 1980

### Candidate Payload Data Summary - Sheet 3

I. Payload Development Schedule

Item Calendar Year

High power 55 GHz transmitters.

1. Design
2. Development
3. Fabrication
4. Integration
5. Test

### K. Special Requirements/Constraints

- To avoid confusion with the tracking and data relay (TDR) mission (which has links between low-earth orbit satellites and a geostationary platform), the term inter-platform link (IPL) has been coined for traffic between platforms.
- 2. This link may be used to control remotely located platforms from the U.S.
- 3. The lowest presently allocated frequency is 55 GHz. As an alternative an optical link may be used.

A 25.25- to 26.25-GHz band has been porposed to the SWARC for this service. For a given antenna aperture, the beamwidth (and pointing accuracy requirements) doubles.

Candidate Payload Data Summary - Sheet 1	Date: March 28, 1980
Code No: COM 12	Description: Provides a data collection and
Name: Data Collection	relay capability to facilitate acquisition of
Category: Communications	data from instruments on or near the earth's
Orbital Location(s): 15° & 110°W	surface.
	See also attachment #1
A. Antenna/Sensor Configuration	B. Transponder/Processor Configuration
TBD	TBD
C. Antenna/Sensor Data	D. <u>Transponder/Processor Data</u>
1. No. 1	1. No4
2. Type: Centerfed reflector	2. Type: Processing transponder
3. Size: 10 meters	3. Transmit Frequency: 400-402 MHz
4. Coverage/FOV: Regional	4. Receive Frequency: 402-403 MHz
5. No. of Beams/Feeds: 4	5. Bandwidth(s)/Data Rate(s): 30/3 kHz
6. Pattern/Beamwidth: 5°	6. Transmit Power/EIRP: 1W
7. Max. Pointing Error: 0.1°	7. Noise Figure/Temperature: 1000°K
8. Sensitivity (G/T):3 dB/K	8. Type of Access/Modulation: PSK/TDMA
9. Peak/EOC Gain: 27 dB EOC	9. On-Board Switching: (M× N) NA
LO. Other:	10. Other:

Candidate Payload Data Summary - Sheet 2

Date:	March	28,	1980	

E.	Weight/Power Estimates	Weight (Kg)	Power (W)	F.	Support Requirements
1.	Antennas/Sensors	30		1.	Sunlight/Eclipse Power:100 watts
2.	Receivers:	20	20	2.	Sunlight/Eclipse, Heat Loss: 340 watts
3.	Transmitters:	20	50	3.	Platform Attitude Control: ±0.5°
4.	Processors:	10	20	4.	Stationkeeping: ±0.1°
5.	Switch Matrix:			5.	Thermal Control: 0-40°C (Radiative)
6.	Power Converters:	10	5	6.	Payload Volume: TBD
7.	Cabling, Harness etc.	10	5	7.	T, T&C/Avionics: √ Yes No
3.	Totals:	100	100	8.	Mission Duration: 8 yrs
€.	Notes:			9.	Mission Duty Cycle: Not during eclipse
				10.	Interconnect Switch: (M×N) TBD
				11.	Other:,
				_	
				1	
3.	Ground Segment			н.	Economic Data
	No. of Stations/Users	s: 50,000+		н.	Economic Data Traffic Capacity:
ι.					
2.	No. of Stations/Users	1 meter		1.	Traffic Capacity:  Space Segment Cost: \$23M
i. 2. 3.	No. of Stations/Users Antenna Size(s):	1 meter		1. 2.	Traffic Capacity:  Space Segment Cost: \$23M  Ground Segment Cost:
l. 2. 3.	No. of Stations/Users Antenna Size(s):  Beamwidth(s):  Peak Gain(s):	1 meter 20° 10 dB		1. 2. 3.	Traffic Capacity:  Space Segment Cost: \$23M  Ground Segment Cost:
L. 2. 3.	No. of Stations/Users Antenna Size(s): Beamwidth(s):	1 meter 20° 10 dB 500°K		1. 2. 3. 4.	Traffic Capacity:  Space Segment Cost: \$23M  Ground Segment Cost:  Estimated Revenue/Yr:
1. 2. 3.	No. of Stations/Users Antenna Size(s):  Beamwidth(s):  Peak Gain(s):  Noise Temperatur	1 meter 20° 10 dB 500°K s: 400-402	MHz	1. 2. 3. 4. 5.	Traffic Capacity:  Space Segment Cost: \$23M  Ground Segment Cost:  Estimated Revenue/Yr:  User Communities: Government  Technology Availability Date: Now
i. i	No. of Stations/Users Antenna Size(s):  Beamwidth(s):  Peak Gain(s):  Noise Temperatur  Receive Frequencie	1 meter 20° 10 dB 500°K s: 400-402	MHz 03 MHz	1. 2. 3. 4. 5.	Space Segment Cost: \$23M  Ground Segment Cost:  Estimated Revenue/Yr:  User Communities: Government  Technology Availability Date: Now  Market Need Date: 1986
3. 1. 2. 3. 4. 5. 6. 7.	No. of Stations/Users Antenna Size(s):  Beamwidth(s):  Peak Gain(s):  Noise Temperatur  Receive Frequencie Transmit Frequencie	1 meter 20° 10 dB 500°K s: 400-402 es: 402-40	MHz 03 MHz	1. 2. 3. 4. 5. 6.	Space Segment Cost: \$23M  Ground Segment Cost:  Estimated Revenue/Yr:  User Communities: Government  Technology Availability Date: Now  Market Need Date: 1986

Car	ndidate Payload D	ata Summary - Sheet 3		Date: March 28, 1980
ı.	Payload Develop	ment Schedule Calendar Year	J.	Supporting Research & Technology Needs
1.	Design			
2.	Development			
3.	Fabrication			
4.	Integration			
5.	Test			

### K. Special Requirements/Constraints

Sensors are placed at strategically selected locations; and the data are accumulated for subsequent burst transmission to the geostationary platform. These burst transmissions may be either on a random multiple access basis (using one or several reservation schemes) or upon request from an interrogating signal from the geostationary platform. Due to the wide range in types of data, both types of transmissions are envisioned.

For some forms of data, very infrequent transmissions may be adequate (e.g., the total rainfall per day). In others (e.g., an intrusion into an area), real time is important. Occasionally, burst frequency may vary depending on local activity (seismic) or the instantaneous needs of the data user (flood stage).

The collected data are switched to a down-link in another service (e.g., high-volume trunking) for transmission to the data user's facility.

Date:	8-3-79	

Code No: EO 1	Description: Payload for detection and				
Name: Lightning Mapper	measurement of visible IR, and RF radiation				
Category:Environmental/Observation	produced by lightning strokes.				
Orbital Location(s):					
A. Antenna/Sensor Configuration	B. Transponder/Processor Configuration				
TBD	TBD				
C. Antenna/Sensor Data	D. Transponder/Processor Data				
1. No. 8	1. No1				
2. Type: Optical Telescope & RF Helices	2. Type: Processor				
3. Size:	3. Transmit Frequency: Platforn. Service				
4. Coverage/FOV: Global	4. Receive Frequency: Visible/IR/L-Ban				
5. No. of Beams/Feeds: 2	5. Bandwidth(s)/Data Rate(s): 3 MBps				
6. Pattern/Beamwidth: RF interferometer	6. Transmit Power(s)/EIRP:Platform Service				
7. Max. Pointing Error: 2 sec (V/IR)	7. Noise Figure/Temperature:				
8. Sensitivity (G/T):	8. Type of Access/Modulation:				
9. Peak/EOC Gain:	9. On-Board Switching: (M× N)				
0. Other:	10 Others				

Date: 8-3-79

E.	Weight/Power Estimates	Weight (Kg)	Power (W)	F.	Support Requirements
1.	Antennas/Sensors			1.	Sunlight/Eclipse Power: 300 watts
2.	Receivers:			2.	Sunlight/Eclipse, Heat Loss: 300 watts
3.	Transmitters:			3.	Platform Attitude Control: ±0.5°
4.	Processors:			4.	Stationkeeping: ±0.1°
5.	Switch Matrix:			5.	Thermal Control: Radiative Cooling
6.	Power Converters:			6.	Payload Volume: 4 cu. meters
7.	Cabling, Harness etc.			7.	T, T&C/Avionics:/ Yes No
8.	Totals:	320	300	8.	Mission Duration: 2 yrs.
9.	Notes:			9.	Mission Duty Cycle:
				10.	Interconnect Switch: (M×N)
				11.	Other:
				_	Outer.
G.	Ground Segment Pla	tform Serv	rice	_	
G.	Ground Segment Pla No. of Stations/Users			н.	Economic Data
1.	No. of Stations/Users	:		н.	Economic Data Traffic Capacity:
	No. of Stations/Users Antenna Size(s):	:		H. 1. 2.	Economic Data Traffic Capacity:  Space Segment Cost:
1. 2.	No. of Stations/Users Antenna Size(s): Beamwidth(s):	:		H. 1. 2. 3.	Economic Data Traffic Capacity: Space Segment Cost: Ground Segment Cost:
1. 2. 3.	No. of Stations/Users Antenna Size(s):  Beamwidth(s):  Peak Gain(s):	:		H. 1. 2.	Economic Data Traffic Capacity: Space Segment Cost: Ground Segment Cost: Estimated Revenue/Yr:
1. 2. 3.	No. of Stations/Users Antenna Size(s): Beamwidth(s):	:		H. 1. 2. 3. 4.	Economic Data Traffic Capacity: Space Segment Cost: Ground Segment Cost:
1. 2. 3. 4.	No. of Stations/Users Antenna Size(s):  Beamwidth(s):  Peak Gain(s):  Noise Temperature:	: s:		H. 1. 2. 3. 4.	Economic Data Traffic Capacity: Space Segment Cost: Ground Segment Cost: Estimated Revenue/Yr: User Communities: Utilities, Forestry, Airline
1. 2. 3. 4. 5.	No. of Stations/Users Antenna Size(s):  Beamwidth(s):  Peak Gain(s):  Noise Temperature:  Receive Frequencie	s:es:		H. 1. 2. 3. 4. 5. 6.	Economic Data  Traffic Capacity:  Space Segment Cost:  Ground Segment Cost:  Estimated Revenue/Yr:  User Communities: Utilities, Forestry, Airline Technology Availability Date: 1985  Market Need Date: Now
1. 2. 3. 4. 5. 6.	No. of Stations/Users Antenna Size(s):  Beamwidth(s):  Peak Gain(s):  Noise Temperature:  Receive Frequencie  Transmit Frequencie	s:es:		H. 1. 2. 3. 4. 5. 6.	Economic Data Traffic Capacity: Space Segment Cost: Ground Segment Cost: Estimated Revenue/Yr: User Communities: Utilities, Forestry, Airline Technology Availability Date: 1985

Car	adidate Payload D	ata Summary - Sheet 3		Date: 8-3-79
ı.	Payload Develop	oment Schedule Calendar Year	J.	Supporting Research & Technology Needs
1. 2. 3. 4. 5.	Design Development Fabrication Integration Test			

K. Special Requirements/Constraints

### Date: 8-3-79 Candidate Payload Data Summary - Sheet 1 Code No: \_\_\_\_ EO 2 Description: Payload collects mesoscale Name: Atmospheric Sounder meteorology data as related to: hurricanes, Category: \_\_\_Environmental/Observation toronados, air pollution, frost, etc. Orbital Location(s):

A. Antenna/Sensor Configuration

See attachment #2

See	also attachment #1
в.	Transponder/Processor Configuration
_	
۵.	Transponder/Processor Data
1.	No1
2.	Type: Processor
3.	Transmit Frequency: Platform Service
4.	Receive Frequency: Visible & IR
5.	Bandwidth(s)/Data Rate(s): 3 MBps
6.	Transmit Power(s)/EIRP: Platform Service
7.	Noise Figure/Temperature:
8.	Type of Access/Modulation:
9.	On-Board Switching: (M× N)
0.	Other:

C. Antenna/Sensor Data Type: Sounding & Imaging Radiometer Size: 40 cm Aperture 4. Coverage/FOV: Global 5. No. of Beams/Feeds: 1 6. Pattern/Beamwidth: High resolution scanner 7. Max. Pointing Error: 8. Sensitivity (G/T): 9. Peak/EOC Gain:

10. Other: \_\_\_\_\_

Date: 8-3-79

# Candidate Payload Data Summary - Sheet 2

_					
E.	Weight/Power Estimates	Weight (Kg)	Power (W)	F.	Support Requirements
1.	Antennas/Sensors			1.	Sunlight/Eclipse Power: 50 watts
2.	Receivers:	185	50	2.	Sunlight/Eclipse, Heat Loss: 50 watts
3.	Transmitters:			-3.	Platform Attitude Control:±0.5°
4.	Processors:	15	50	4.	Stationkeeping:
5.	Switch Matrix:			5.	Thermal Control: Radiative Cooling
6.	Power Converters:			6.	Payload Volume: 1 cu meter
7.	Cabling, Harness etc.			7.	T, T&C/Avionics:/ Yes No
8.	Totals:	185	100	8.	Mission Duration: 2 yrs
9.	Notes:			9.	Mission Duty Cycle:100%
				10.	Interconnect Switch: (M×N)
				11.	Other:
_		_			
G.	Ground Segment	Platform S	Service	н.	Economic Data
1.	No. of Stations/Users			1.	Traffic Capacity:
2.	Antenna Size(s):			2.	Space Segment Cost: \$10M
3.	Beamwidth(s):			3.	Ground Segment Cost:
4.	Peak Gain(s):			4.	Estimated Revenue/Yr:
5.	Noise Temperature:			5.	User Communities: NOAA & Weather Cente
6.	Receive Frequencies			6.	Technology Availability Date: 1985
7.	Transmit Frequenci	es:		7.	Market Need Date: Now
8.	Modulation/Access:			8.	Other:
9.	Transmit Power:				
10.	Other:				

Ca	ndidate Payload D	ata Summary - Sheet 3		Date:
ı.	Payload Develop	oment Schedule	J.	Supporting Research & Technology Needs
	Item	Calendar Year		
1.	Design			
2.	Development			
3.	Fabrication			
4.	Integration			
5.	Test			
			I	

K. Special Requirements/Constraints

#### ADVANCED ATMOSPHERIC SOUNDING AND IMAGING RADIOMETER

#### OBJECTIVE/MISSION DESCRIPTION

The objective of this mission to collect mesoscale meterology data continuously as related to:

- a. Clear air turbulence
- b. Hurricanes
- c. Flash floods
- d. Severe storms and tornadoes
- e. Frost
- f. Wind
- g. Air pollution

The availability of this data will aid in the prevention of loss of life and property caused by the occurrence of these phenomena.

The mission will consist of analyzing the data obtained from launching the Mayanged Atmospheric Sounding and Imaging Radiometer and provide warning to localities of pending storms. A model of this instrument is shown in Figure 1.

The infrared sounder, complemented by the microwave sounder, will allow the study of the temperature profiles and other phenomena in the mesosphere as related to the probability of occurrence of severe weather conditions. To attain the stated objective, continuous data is required.

The indivanced Atmospheric Sounding and Imaging Radiometer will provide either raw or pre-processed data to small earth stations in localities needing the information for their own warning and protection. The number of users for this system will increase rapidly and will eventually be unlimited and the data provided will be continuous.

#### JUSTIFICATION, NEED

The mission will provide a vital source of previously unattainable information needed to understand and forecast weather conditions more accurately by:

- a. Improved access to the vertical dimension
- b. Filling time and space gaps in present observations

c. Complementing TIROS, GOES, and other weather satellite and balloon measurements and observations.

With data from the Advanced Atmospheric Sounding and Imaging Radiometer localized weather phenomena can be predicted in a timely manner. Present systems, although greatly improved over the past 10 years, produce predictions at 4-6 hour intervals covering areas of 800 x 800 km. This type of time and space coverage is of little value to predicting sudden, small area weather conditions needed for localized storms such as tornadoes, flash floods, etc. With the proposed system, time will be reduced to 5-15 minutes and area to 20 x 30 km. Very substantial reduction in loss of life and property can result from the use of this system.

### USER COMMUNITY

Primary users will be NOAA and state weather watch centers. Other users will include USDA, universities, maritime shipping, and fisheries, to name a few.

The tornado occurring localities would benefit greatly from implementation of this system.

Candidate Payload Data Summary - Sheet 1	Date: 8-1-79			
Code No: EO 3	Description: High resolution optical scanning radiometer for weather imaging as an aid to			
Name: Visual & IR Radiometer				
Category: Environmental/Observation	severe storm forecasting			
Orbital Location(s): TBD				
A. Antenna/Sensor Configuration	B. Transponder/Processor Configuration			
C. Antenna/Sensor Data	D. Transponder/Processor Data			
1. No. 1	1. No1			
2. Type: Imaging Radiometer	2. Type: Processor			
3. Size: 1 meter aperture	3. Transmit Frequency: Platform Service			
4. Coverage/FOV: Global	4. Receive Frequency: 3-15 micrometers			
5. No. of Beams/Feeds: 1	5. Bandwidth(s)/Data Rate(s): 6 Mbps			
6. Pattern/Beamwidth: High resolution scanner	6. Transmit Power(s)/EIRP: Platform Service			
7. Max. Pointing Error: 0.5 micro-radians	7. Noise Figure/Temperature:			
8. Sensitivity (G/T):	8. Type of Access/Modulation: PSK			
9. Peak/EOC Gain:	9. On-Board Switching: (M× N) TBD			
10 Other	10 Other:			

Date: 8-1-79

E.	Weight/Power Estimates	Weight (Kg)	Power (W)	F.	Support Requirements
1.	Antennas/Sensors			1.	Sunlight/Eclipse Power: 100 watts
2.	Receivers:			2.	Sunlight/Eclipse, Heat Loss: 100 watts
3.	Transmitters:			3.	Platform Attitude Control: Orbit determination within
4.	Processors:			4.	Stationkeeping: 300 m.
5.	Switch Matrix:			5.	Thermal Control: Radiative cooling
6.	Power Converters:			6.	Payload Volume:TBD
7.	Cabling, Harness etc.			7.	T, T&C/Avionics: Yes No
8.	Totals:	500	100	8.	Mission Duration: TBD
9.	Notes:		,	9.	Mission Duty Cycle:
				10.	Interconnect Switch: (M×N)
				11.	Other:
_					
G.	Ground Segment			н.	Economic Data
1.	No. of Stations/User	s: Platfor	m Service	1.	Traffic Capacity:
2.	Antenna Size(s):			2.	Space Segment Cost:
3.	Beamwidth(s):			3.	Ground Segment Cost:
4.	Peak Gain(s):			4.	Estimated Revenue/Yr:
5.	Noise Temperature:			5.	User Communities: Government/Academic
6.	Receive Frequencie	s:		6.	Technology Availability Date: Now
7.	Transmit Frequenc	ies:		7.	Market Need Date: Now
8.	Modulation/Access:			8.	Other:
9.	Transmit Power:				
10.	Other:				

Candidate Payload Data Summary - Sheet 3	Date: 8-1-79
I. Payload Development Schedule  Item Calendar Year	J. Supporting Research & Technology Needs
1. Design 2. Development 3. Fabrication 4. Integration 5. Test	

K. Special Requirements/Constraints

Code No: \_\_\_\_\_EO4

10. Other:

Date: 8-7-79

Description: High resolution microwave

Name:	Microwave Radiometer	ımagı	ng radiometer for research into severe
Category: Environmental/Observation		storn	n forecasting.
Orbital	Location(s): TBD	also	o see attachment #1
A. An	tenna/Sensor Configuration	в.	Transponder/Processor Configuration
	See attachment #2	See	e attachment #3
C. Ar	ntenna Sensor Data	D.	Transponder/Processor Data
	o. 1	1.	No1
	ype: Offset fed reflector	2.	Type: Processor
	ize: 4.4 meters	3.	Transmit Frequency: Platform Service
	overage FOV: Global	4.	Receive Frequency: 118/183 GHz
	o. of Beams/Feeds: 1	5.	Bandwidth(s)/Data Rate(s): 500 Bps
	attern/Beamwidth: 0.03° scanning beam	6.	Transmit Power(s)/EIRP: Platform Service
7. M	lax. Pointing Error: 0.03°	7.	Noise Figure/Temperature:
8. S	ensitivity (G/T):	8.	Type of Access/Modulation: PSK
	Peak/EOC Gain:	9.	On-Board Switching: (M× N) TBD

10.

Other:

Date: 8-7-79

Ε.	Weight/Power Estimates	Weight (Kg)	Power (W)	F.	Support Requirements
1.	Antennas/Sensors	56	20	1.	Sunlight/Eclipse Power: 150 watts
2.	Receivers:	50	130	2.	Sunlight/Eclipse, Heat Loss: 150
3.	Transmitters:			3.	Platform Attitude Control:
4.	Processors:	30		4.	Stationkeeping: Orbit determination within 300 meters
5.	Switch Marix:			5.	Thermal Control: Radiative cooling
6.	Power Converters:			6.	Payload Volume:
7.	Cabling, Harness etc.			7.	T, T&C/Avionics: / Yes No
8.	Totals:	136	150	8.	Mission Duration: 2 yrs.
9.	Notes:			9.	Mission Duty Cycle: 100 %
				10.	Interconnect Switch: (M×N)
				11.	Other:
_				_	
G.	Ground Segment			н.	Economic Data
1.	No. of Stations/User	s: Platfor	m Service	1.	Traffic Capacity:
2.	Antenna Size(s):			2.	Space Segment Cost: \$15M
3.	Beamwidth(s):			3.	Ground Segment Cost:
4.	Peak Gain(s):			4.	Estimated Revenue/Yr:
5.	Noise Temperature:			5.	User Communities: Government & Academic
6.	Receive Frequenci	e s:		6.	Technology Availability Date: Now
7.	Transmit Frequenc	cies:		7.	Market Need Date: Now
8.	Modulation/Access:			8.	Other:
9.	Transmit Power:				
10.					

Date: 8-7-79

Ι.	Payload Develop	ment Schedule	J.	Supporting Research & Technology Needs
	Item	Calendar Year		
				·
1.	Design .			
2.	Development			
3.	Fabrication			
4.	Integration			
5.	Test			

K. Special Requirements Constraints

#### MICROWAVE ATMOSPHERIC SOUNDING RADIOMETER

#### OBJECTIVE/MISSION DESCRIPTION

The objective of this payload is to monitor and predict trends in the severity of thunderstorms and tropical cyclones by continous measurement of three-dimensional atmospheric temperature and relative humidity.

The mission will consist of a microwave radiometer. Thermal radiance of the atmosphere will be determined using the 118 GHz oxygen absorption line. Humidity will be determined from the 193 GHz H<sub>2</sub>O vapor line. The experimental data will be transmitted to Earth using existing geosynchronous platform communication channels. Likewise, command and control will use existing sub-system of the platform.

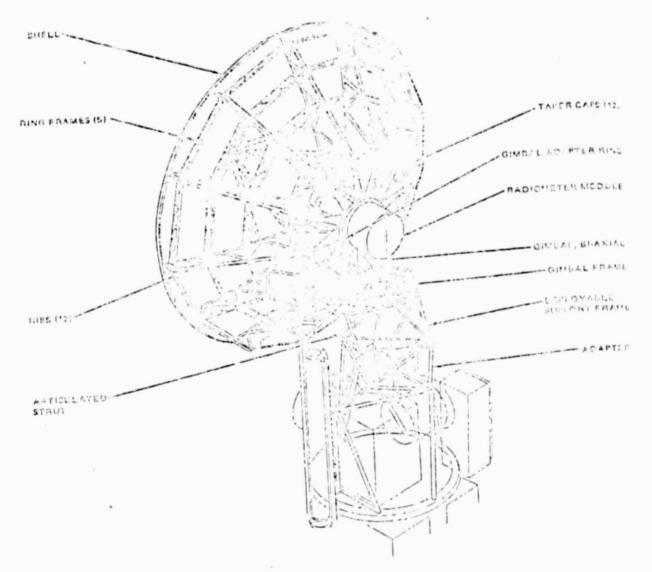
#### JUSTIFICATION/NEED

Severe storms analysis and prediction require rapid observation cycle (of the order of 1 hour or less) which can only be obtained from geosynchronous platforms or a large fleet of lower Earth orbiting satellites. Current geosynchronous meteorological satellites have only IR and visible channels which are useless for severe storm observation, because there will always be extended cloudy areas.

Microwaves can "see through" most of non-raining clouds. Microwave radiometry can be used to measure atmopsheric temperature profiles and humidity profiles. It can also be used to infer wind velocity field from temperature measurements. The "temperature anomally" or "hot spot" near the eye of a storm or hurricane, is a good indicator of the storm system. These indicators can only be measured by a microwave system described here.

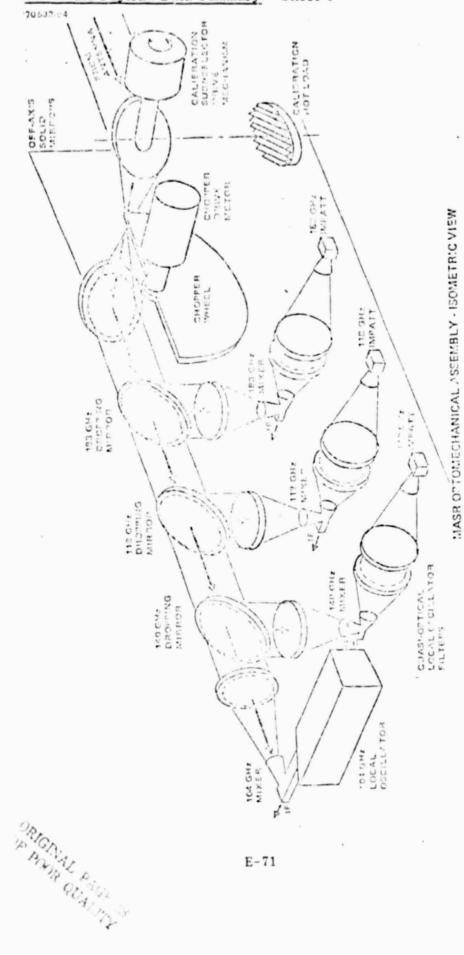
#### USER COMMUNITY

The metcorological data will be used by NASA, NOAA, DOD, and universities involved in atmospheric and meteorological research. Of principal interest is the application of these data to monitoring and forecasting of hurricane and severe thunderstorm activity.



MANR baseline antenna system

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Date: 8-2-79

Code No: EO 5	Description: Provides a facility for tracking			
Name: R.F. interferometer	balloons, buoys, land vehicles and ships to			
Category: Environmental/Observation	an accuracy of 1 Km.			
Orbital Location(s): TBD	See also attachment #1			
A. Antenna/Sensor Configuration	B. Transponder/Processor Configuration			
See attachment #2				
•				
C. Antenna Sensor Data	D. Transponder/Processor Data			
1. No. 7	1. No1			
2. Type: Helices	2. Type: Processor			
3. Size:	3. Transmit Frequency: Platform Service			
4. Coverage FOV: Global	4. Receive Frequency: 1.2 GHz			
5. No. of Beams Feeds: 7	5. Bandwidth(s)/Data Rate(s): TBD			
6. Pattern/Beamwidth: 22°	6. Transmit Power(s)/EIRP: Platform Service			
7. Max. Pointing Error: ±0.1°	7. Noise Figure/Temperature:			
8. Sensitivity (G-T):	8. Type of Access/Modulation:			
9. Peak/EOC Gain: 17.5 dB	9. On-Board Switching: (M× N)			
10. Other:	10. Other:			

8-2-79

Date:

## Candidate Payload Data Summary - Sheet 2

					and a sufficient of the property of the supplication of
E.	Weight/Power Estimates	Weight (Kg)	Power (W)	F.	Support Requirements
1.	Antennas/Sensors	7		1.	Sunlight/Eclipse Power: 215
2.	Receivers:	50	200	2.	Sunlight/Eclipse, Heat Loss: 215
3.	Transmitters:			3.	Platform Attitude Control: ±0.5°
4.	Processors:	5	15	4.	Orbit determination within 300 meters.
5.	Switch Matrix:	1.		5.	Thermal Control: Radiative cooling
6.	Power Converters:			6.	Payload Volume: 1.5 cu. M
7.	Cabling, Harness etc.	50		7.	T, T&C/Avionics: / Yes No
8.	Totals:	112	215	8.	Mission Duration:
9.	Notes:			9.	Mission Duty Cycle: 100%
				10.	Interconnect Switch: (M×N)
				11.	Other:
_				-	
G.	Ground Segment			H.	Economic Data
1.	No. of Stations/User	s:Platform	Service	1.	Traffic Capacity:
2.	Antenna Size(s):		·	2.	Space Segment Cost: \$15M
3.	Beamwidth(s):			3.	Ground Segment Cost:
4.	Peak Gain(s):			4.	Estimated Revenue/Yr:
5.	Noise Temperature:			5.	User Communities: Government, Academ
6.	Receive Frequencie	es:		6.	Technology Availability Date: Now
7.	Transmit Frequezo	ies:		7.	Market Need Date: Now
8.	Modulation/Access:			8.	Other:
•					
9.	Transmit Power:				

#### INTERFEROMETER

#### OBJECTIVE/MISSION

The objective of the interferometer is to provide an on-board facility at L-band for tracking balloons, drifting buoys, land vehicles, and ships to an accuracy of 1 km.

There is an urgent need by meteorologists to determine wind velocity at a constant altitude to an accuracy of 1 km per hour in order to predict weather conditions more accurately. The system could accommodate up to 1500 balloons containing beacons and moving at a constant altitude. The balloons would also have temperature and pressure readouts on the 1 watt beacon.

The passage of Public Law 94-265, the Fishery Conservation and Management Act of 1976, extended U.S. responsibility for fisheries management to a 200-nautical mile zone covering 2.2 million square miles of ocean along an 8,700-mile perimeter. The Tanker and Vessel Safety Act of 1977 provides for major amendments to the Ports and Waterways Safety Act of 1972 which call for increased navigational safety within a 200-nautical mile marine safety zone.

#### MISSION PAYLOAD DESCRIPTION

#### a. Functional

Four helical antennas will be spaced as far apart as possible on the earth viewing side of the structure forming a large cross as shown in Figure 1. Three more will be spaced closer together on the structure to resolve ambiguity. These circularly polarized antennas will have a 22 degree beamwidth and 17.5 dB gain at L-band. The interferometer systems functional diagram is shown in Figure 2.

The beacon signal from the Earth containing the I.D. code, the temperature and pressure, is of 8 second duration and is turned on every two hours by the beacon timer. An inexpensive oscillator operates as a free running clock with low accuracy which enhances operation of the random multiple access mode to the platform.

The advantages of an interferometer are that the spacecraft electronics system is simplified. It employs a simple oscillator such that maintaining stability is not a problem. The spacecraft needs no auxillary equipment on-board and uses a one way transmission only. Only one spacecraft is used; therefore, it provides coverage for the entire Earth disc (field of view).

NOTE: Although the above describes the balloon system, the interferometer applications for buoys, aircraft, ships, and land-mobile are similar.

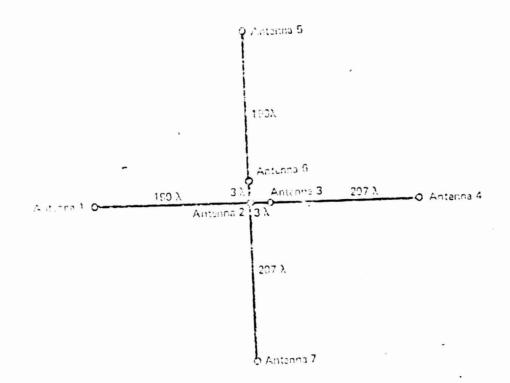


Figure 1 . Caselines

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Payload #31

Mission Name: Defense Meterological Satellite Program Data Relay

Mission Description: This payload is designed to relay 2-3 MBPS from 3 satellites in 450 n.m. sun synchronous orbits (98.7° inclincation). The payload will operate in the 1-3 GHz frequency band. Maximum of 30 minutes delay in data reception. Desired IOC of 1985.

### Platform Interface Requirements:

Weight: 150 Kg Power: 100 watts

Volume:

Thermal Control:

Pointing Accuracy: ±0.3°

Other:

Experimenter: Capt. Ed Merz

Organization: SAMSO

Telephone No.: (213) 643-0708

Payload #31

Mission Name: Defense Meterological Satellite Program Data Relay

Mission Description: This payload is designed to relay 2-3 MBPS from 3 satellites in 450 n.m. sun synchronous orbits (98.7° inclincation). The payload will operate in the 1-3 GHz frequency band. Maximum of 30 minutes delay in data reception. Desired IOC of 1985.

### Platform Interface Requirements:

Weight: 150 Kg
Power: 100 watts

Volume:

Thermal Control:

Pointing Accuracy: ±0.3°

Other:

Experimenter: Capt. Ed Merz

Organization: SAMSO

Telephone No.: (213) 643-0708

Payload #32

Mission Name: Advanced Operations Linescan System Cloud Imager

Mission Description: Will provide mosaic storage of cloud images.

### Platform Interface Requirements:

Weight: 150 Kg Power: 150 watts

Volume:

Thermal Control: Radiative cooling of IR detector

Pointing Accuracy: ± 0.01°

Other:

Experimenter: Capt. Ed Merz

Organization: SAMSO

Telephone No.: (213) 643-0708

Payload #33

Mission Name: Materials Exposure/Unrecovered

Mission Description: Will monitor on orbit failure of electronic devices. Effects will be correlated with the output of a charged particle monitor.

### Platform Interface Requirements:

Weight: 10 Kb Power: 25 watts

Volume:

Thermal Control:
Pointing Accuracy:

Other:

Experimenter: AFGL

Payload #34

Mission Name: Adaptive Control of Space Structures Demonstration

Mission Description: Will demonstrate ability to satisfy HALO requirements by active control of a 4 meter diameter test structure. Disturbance and high rate slewing motions will be simulated. Structure orientation will be varied from earth to black space to check albeds effects.

### Platform Interface Requirements:

Weight: 1200 Kg Power: 500 watts

Volume:

Thermal Control:

Pointing Accuracy: ±0.030°

Other:

Drift < 0.2 microradians

Jitter < 0.02 microradians

Experimenter: Tom Pitts Organization: RADC

Telephone No.: (315) 330-3148

Payload #35

Mission Name: Mirror Control Experiment (HALO)

Mission Description: Will determine the line of sight stability of a 2-3 meter segmented mirror. The mirror will be cryogenically cooled, possibly combined with integral cooling to 100-150°K.

### Platform Interface Requirements:

Weight: 1200 Kg 300 watts

Power:

Volume:

Thermal Control: Pointing Accuracy:

Other:

Experimenter: Tom Pitts Organization: RADC

Telephone No.: (315) 330-3148

Payload #36

Mission Name: Advanced On-Board Signal Processor

# Mission Description:

# Platform Interface Requirements:

Weight:

Power:

Volume:

Thermal Control:

Pointing Accuracy:

Other:

Experimenter: John McNamara/Tom Pitts

Organization:

RADC

Telephone No.: (315) 330-4437/3148

Payload #37

Mission Name: Pulsed Plasma Propulsion

Mission Description: Will test suitability of pulsed plasma propulsion units for space vehicle attitude control and north/south station keeping.

### Platform Interface Requirements:

Weight: 360 Kg Power: 680 watts

Volume:

Thermal Control:
Pointing Accuracy:

Other: Possible RF compatibility problem due to radiation from arc.

Experimenter: Jerry Sayles

Organization: AFRPL

Telephone No.: (805) 277-5342

Payload #38

Mission Name: Aerosol & Cloud Height Sensor

Mission Description: Downward-looking scanning telescope covering earth's disc which uses filtered back scattered sunlight to sense altitudes of water vapor and gas layers.

### Platform Interface Requirements:

Weight: 50 Kg

Power: 100 watts (27 volts) Volume: 0.75 cu meter

Thermal Control:

Pointing Accuracy: ±0.1°
Other: 1 year mission life

Experimenter: AFGL

Payload #39

Mission Name: Solar Flare Monitor

Mission Description: Will provide x-ray and gamma ray imaging of the solar surface.

The results will be correlated with in-situ measurements of charged particles (protons, electrons, etc.).

### Platform Interface Requirements:

Weight: 100 Kg

Power: 100 watts (27 volts) Volume: 0.75 cu. meter

Thermal Control:

Pointing Accuracy: ±1.0° Other: Sun-orientation

6 month to 1 year mission life

Experimenter: AFGL

Payload #40

Mission Name: Solar Flare Isotope Monitor

### Mission Description:

### Platform Interface Requirements:

Weight: 13 Kg

Power: 6 watts

Volume:

Thermal Control:

Pointing Accuracy:

Other:

Experimenter: J. A. Simpson

Organization: University of Chicago

Telephone No.: (312) 753-8541

Payload #41

Mission Name: Energetic Proton & Heavy Ion Sensor

Mission Description:

# Platform Interface Requirements:

Weight: 8 Kg
Power: 6 watts

Volume:

Thermal Control:
Pointing Accuracy:

Other:

Experimenter: R. D. Sharp Organization: Lockheed

Telephone No.: (415) 493-4411, Ext. 45884

Payload #42

Mission Name: Global Ultraviolet Radiance

Mission Description: Will use imaging sensors (digicon) at the focal plane of an ultraviolet spectrometer to obtain spatial correlation. The sensors will scan the earth's disc from nadir to limb.

### Platform Interface Requirements:

Weight: 50 Kg

Power: 20 watts (27 volts) Volume: 0.4 cu. meter

Thermal Control:

Pointing Accuracy: ±0.1°

Other: 1 month minimum mission duration

Experimenter: AFGL

Payload #43

Mission Name: Magnetic Substorm Monitor

Mission Description: Will use particle sensors and magnetometers to measure fluxes and fields. Spinning sensor required.

### Platform Interface Requirements:

Weight: 5 Kg

Power: 5 watts (27 volts) Volume 0.1 cu. meter Thermal Control: Pointing Accuracy:

Other:

Experimenter: AFGL

Payload #44

Mission Name: Charged Particle Monitor

Mission Description: Will measure particles with energies in the range 1 eV to 100 eV and provide a time-history of particle flux levels. Monitor will be oriented along the platform velocity vector and will require 2000 sq. meters of conducting surface.

# Platform Interface Requirements:

Weight: 5 Kg

Power: 10 watts

Volume: 0.1 cu. meter

Thermal Control:

Pointing Accuracy: ± 0.1°

Other: 6 Months to 1 year mission duration

Experimenter: AFGL

Payload #45

Mission Name: Materials Exposure/Recovered

Mission Description: Will monitor on-orbit degradation/failure of solid state device fabrication materials, multilayer insulation, thermal control coatings, and conductive charge control elements. The payload must be retrievable.

### Platform Interface Requirements:

Weight: 140 Kg

Power: Volume:

Thermal Control:
Pointing Accuracy:

Other:

Experimenter: Mr. Bill Lehn

Organization: AFML

Telephone No.: (573) 255-3028

Payload #46

Mission Name: Solar Ultraviolet Irradiance

Mission Description: Will monitor solar ultraviolet radiance with two spectrometers which require annual recalibration. The spectrometers will operate for 5 minutes/day for 1-11 years.

### Platform Interface Requirements:

Weight: 50 Kg

Power: 10 watts (27 volts) Volume:  $95 \times 26 \times 12$  cm.

Thermal Control:

Pointing Accuracy: ±1° (at sun)
Other: Requires periodic retrieval

Experimenter: AFGL

Payload #47

Mission Name: Cosmic Ray Monitor

Mission Description: Will measure isotopic composition of cosmic rays with active (electronic) and passive (plastic/emulsion) detectors. Exposure in the ecliptic plane required.

# Platform Interface Requirements:

Weight: 250 Kg

Power:

Volume: 0.75 cu. meter

Thermal Control:
Pointing Accuracy:

Other: 1 month to 1 year mission duration

Experimenter: AFGL

Payload #48

Mission Name: Mini-High Altitude Large Optics Program

### Mission Description:

### Platform Interface Requirements:

Weight: 700 Kg

Power: 1000 watts

Volume:

Thermal Control:

Pointing Accuracy: ±0.03°

Drift <0.5 microrad/sec

Jitter (0.05 microrad RMS (0.1 to 1 Hz)

Experimenter:

Organization:

DARPA

Telephone No.:

(202) 494-3007

Payload #49

Mission Name: Mosaic Sensor Program

Mission Description:

## Platform Interface Requirements:

Weight:

900 Kg

Power:

650 watts

Volume:

Thermal Control:

Pointing Accuracy: ±0.03°

Other: Stabilization to 0.1 arc sec/sec in a 0.1 to 5 Hz frequency band

Experimenter: Lt Col Tom May Organization: SAMSO/YCD Telephone No.: (213) 643-1262

Payload #50

Mission Name: Space Based Radar Experiment/Demonstration

Mission Description: Will demonstrate SBR performance characteristics by deploying a 20 meter or more diameter antenna, to permit pattern measurements with 100 or more T/R modules. Line of sight aperture sensing tests and clutter measurements will also be performed.

### Platform Interface Requirements:

Weight: 900 Kg Power: 20,000 watts

Volume:

Thermal Control:
Pointing Accuracy:

Other:

Experimenter: Lt Col Tom May Organization: SAMSO/YCD Telephone No.: (213) 643-1262

Payload #51

Mission Name: Cryogenic Infrared Radiator

Mission Description: Measure the performance of a large very low temperature radiator which would be used to passively cool infrared sensor components.

## Piatform Interface Requirements:

Weight: 120 Kg

Power:

Volume: Radiating surface area 10 sq. meters

Thermal Control: Pointing Accuracy:

Black space orientation

Experimenter:

Bill Haskin

Organization:

AFFDL

Telephone No.: (513) 255-4853

Payload #52

Mission Name: BOSS Evaluation

Mission Description: Will provide IR surveillance from space using a 0.5 meter diameter telescope with an optics temperature of  $200^{\circ}$ K and a detector temperature of  $77^{\circ}$ K. Telescope will scan  $\pm 30^{\circ}$  from the nadir.

### Platform Interface Requirements:

Weight: 150 Kg

Power: 400 watts (27 volts)

Volume: 1 cu. meter

Thermal Control:

Pointing Accuracy: ±5 arc secs

Other: Minimum mission duration of 2 weeks. Optical systems need protection

from contaminants.

Experimenter: Rene Cormier

Organization: AFFDL

Telephone No.: (513) 255-4853

Payload #53

Mission Name: GEMINI Evaluation

Mission Description: Will provide IR surveillance from space using two 0.5 meter diameter telescopes with a 5 meter separation. The telescopes will scan ±30° from the nadir Telescope optics temperature of 200°K and a detector temperature of 77°K is required.

### Platform Interface Requirements:

Weight:

820 Kg

Power:

**1800** watts

Volume:

20 cu. meters

Thermal Control:

Pointing Accuracy: 25 arc secs.

Other:

Minimum mission duration of 2 weeks. Optical systems need

protection from contamination.

Experimenter:

Rene Cormier

Organization:

AFGL

Telephone No.: (617) 861-3606

Payload #54

Mission Name: **EHF System** 

Mission Description:

# Platform Interface Requirements:

Weight:

230 K

Power:

500 watts

Volume:

Thermal Control:

Pointing Accuracy:

Other:

Experimenter: Maj Jerry Fjetland

Organization: SAMSO

Telephone No.:

Payload #55

Mission Name: Aircraft Laser Relay

Mission Description:

## Platform Interface Requirements:

Weight: 320 Kg

Power: 550 watts

Volume:

Thermal Control:
Pointing Accuracy:

Other:

Experimenter: Maj Jerry Fjetland

Organization: SAMSO

Telephone No.:

Payload #56

Mission Name: Fiber Optics Demonstration

Mission Description:

### Platform Interface Requirements:

Weight:

12 Kg

Power:

30 watts

Volume:

Thermal Control:

Pointing Accuracy:

Other:

Requires a 1 MBps Digital Data Link

Experimenter: Dave Zann Organization: AFAL Telephone No.: 785-4594

Payload #57

Mission Name: Space Sextant

Mission Description: Demonstrate space sextant performance characteristics, e.g., non radiating, autonomous operation, immune to ground based jamming, self calibrating.

## Platform Interface Requirements:

Weight: 85 Kg
Power: 220 watts

Volume:

Thermal Control: ~40°F +10°

Pointing Accuracy: ±10°

Other: Field of view must include sky and moon.

Experimenter: Barbara Corn/Lt James/Capt Roberts

Organization: SAMSO/YCD

Telephone No.: (213) 648-7044/643-1414

Payload #58

Mission Name: Passively Damped Structure

Mission Description: Demonstrate a structure with integral passive damping such as would be required for a precision pointing and tracking system or a stable platform.

### Platform Interface Requirements:

Weight:

Power:

Volume:

Thermal Control:

Pointing Accuracy:

Other:

Experimenter:

Dr. Lynn Rogers

Organization:

AFFLD

Telephone No.:

(513) 255-2967

Payload #59

Mission Name: Thermally Stable Structure

Mission Description: Demonstrate a thermally stable structure which can provide precise alignment with limited deflections due to thermal gradients.

## Platform Interface Requirements:

Weight:

Power:

Volume:

Thermal Control:

Pointing Accuracy:

Other:

Experimenter: Jack Wood Organization: AFFDL

Telephone No.: (513) 255-3736

Payload #60

Mission Name: Electronic Counter Counter Measures Processing TDMA

Mission Description:

# Platform Interface Requirements:

Weight:

Power:

Volume:

Thermal Control:

Pointing Accuracy:

Other:

Experimenter: Tom Treadway

Organization: RADC

Telephone No.: (315) 330-3046

Payload #61

Mission Name: Lasercom - Space to Ground

# Mission Description:

### Platform Interface Requirements:

Weight: 250 Kg Power: 830 watts

Volume:

Thermal Control:

Pointing Accuracy: ±0.1°

Other:

Experimenter:

Organization: SAMSO/SKX Telephone No.: (213) 643-1761

Payload #62

Mission Name: Enhanced IR Emissions

Mission Description:

### Platform Interface Requirements:

Weight: 480 Kg

Power:

300 watts

Volume:

Thermal Control:

Pointing Accuracy: ±0.1°

Other:

Experimenter: Dr. Stair

Organization: AFGL

Telephone No.: ( ) 861-4910

Payload #63

Mission Name: AIRGLOW Far - UV Radiometers

## Mission Description:

# Platform Interface Requirements:

Weight: 20 Kg
Power: 1 watt

Volume:

Thermal Control:

Pointing Accuracy: ±10°

Other:

Experimenter: C.B. Opal

Organization: NRL

Telephone No.: (202) 767-2764

Payload #64

Mission Name: Particle Beam - Emission System

Mission Description:

### Platform Interface Requirements:

Weight:

Power:

Volume:

Thermal Control:

Pointing Accuracy:

Other:

Experimenter:

Organization:

Telephone No.:

Payload #65

Mission Name: Particle Beam - Ionospheric Effects

Mission Description:

# Platform Interface Requirements:

Weight:

Power:

Volume:

Thermal Control:

Pointing Accuracy:

Other:

Experimenter:

Organization:

Payload #66

Mission Name: Particle Beam - Plasma Precipitation

Mission Description:

## Platform Interface Requirements:

Weight:

Power:

Volume:

Thermal Control:

Pointing Accuracy:

Other:

Experimenter:

Organization:

Payload #67

Mission Name: Dynamic Power System

Mission Description:

### Platform Interface Requirements:

Weight:

250 Kg

Power:

200 watts

Volume:

Thermal Control:

Pointing Accuracy:

Other:

Experimenter:

Organization:

Payload #68

Mission Name: Battlefield Illumination

Mission Description:

## Platform Interface Requirements:

Weight:

Power:

Volume:

Thermal Control:

Pointing Accuracy:

Other:

Experimenter: Organization:

Fayload #69

Mission Name: Battlefield Cloud/Fog Dissipation

Mission Description:

## Platform Interface Requirements:

Weight:

Power:

Volume:

Thermal Control:

Pointing Accuracy:

Other:

Experimenter:

Organization:

Payload #71

Mission Name: Earth Viewing Optical Telescope

### Mission Objectives:

- 1. High resolution studies of atmospheric structure.
- 2. Studies of wind velocity and flow regions.
- 3. Investigations of variations of major and minor constituents of the earth's atmosphere.
- 4. Small scale density and temperature structure and dynamics.
- 5. Transition regions structure and dynamics.

### Platform Interface Requirements:

Weight:

1100 Kg

Power:

2000 watts

. Volume:

 $1.5m \times 2m$ 

Thermal Control:

Pointing Accuracy:

± 1.0 arc sec.

Other:

Experimenter:

Organization: NASA-OSS

Payload #72

Mission Name: Particle Beam Injection Facility

### Mission Objectives:

- 1. Studies of the effects of <u>controlled energy injections</u> in the auroral zones.
- 2. Active investigations of sub-storm onset conditions.
- 3. Investigations of the effects of induced ionization paths to release magnetotail energy.
- 4. Determination of the location, extent, and conditions for magentospheric electric fields.

### Platform Interface Requirements:

Weight:

500 Kg

Power:

1000 watts

Volume:

 $0.5 \times 1.0 \times 2.5$  meters

Thermal Control:

Pointing Accuracy:

±1°

Other:

Experimenter:

Organization:

Payload #73

Mission Name: Chemical Release Module Observations

### Mission Objectives:

- Determine entry points in the magnetosphere for the solar wind 1.
- Investigate the transport paths and mechanisms for magnetospheric 2. plasmas.
- Investigate acceleration processes for magnetospheric plasmas. 3.

### Platform Interface Requirements:

Weight

200 Kg

Power:

250 watts

Volumer

 $0.5m \times 1.5m$ 

Thermal Control:

Pointing Accuracy: ±0.01°

Other:

Experimenter:

Organization:

Payload #74

Mission Name: Plasma Diagnostic Satellite

### Mission Objectives:

- To provide a remote, maneuverable, free flying platform to make 1. correlative measurements of particles and fields perturbed by wave injections and particle injections.
- To provide background information on the unperturbed environment 2. which may be used to calibrate the effects of perturbations.
- To carry instruments away from the perturbation source to increase 3. the spatial experiment coverage.

### Platform Interface Requirements:

Weight:

1000 Kg

Power:

100 watts

Volume:

 $1.5m \times 2m$ 

Thermal Control:

Pointing Accuracy: ±0.01°

Other:

Experimenter:

Organization:

Payload #75

Mis.ion Name: Imaging Spectrometric Observatory

### Mission Objectives:

- Determination of distributions of atmospheric constituents 1.  $(0_2, N_2, NO, O, H_2^+, O^+)$
- Studies of atmospheric motions and flow patterns. 2.
- Investigations of atmospheric constituent variations on a 3. global scale.
- Dynamics of auroral and airglare phenomena. 4.

### Platform Interface Requirements:

Weight.

350 Kg

Power:

150 watts

Volume:

 $1.5m \times 1.5m \times 2.0m$ 

Thermal Control:

Pointing Accuracy: ±0.1°

Other:

Experimenteur

Organization:

Mission Name: Fabry-Perot Interferometer/Photometer

### Mission Objectives:

- 1. Obtain high resolution interferometric observations to provide doppler velocity and temperature measurements of specific constituents.
- 2. Perform high resolution, high throughput photometry.
- 3. To determine the prevailing wind structure of the atmosphere on a global basis.

## Platform Interface Requirements:

Weight:

150 Kg

Power:

200 watts

Volume:

 $0.5 \text{m} \text{ dia} \times 2.5 \text{m}$ 

Thermal Control:

Pointing Accuracy: ±1 sec of arc.

Other:

Experimenter:

Organization -

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Payload #77

Mission Name: IR Occultation Instrument

### Mission Objectives:

- 1. Obtain high resolution spectra of the atmosphere seen in absorption, with the sun as the source.
- To determine densities and distributions of trace gases in 2. the atmosphere.
- To gather high resolution spectra of radiation reflected from 3. the lower atmosphere.

#### Platform Interface Requirements:

Weight:

200 Kg

Power:

400 watts

Volume.

 $0.5m \times 1.0m \times 2.5m$ 

Thermal Control

Pointing Accuracy: ±0.1°

Other:

Experimenters

Organization:

Payload #78

Mission Name: Cryogenically Cooled Limb Scanner

## Mission Objectives:

- Determine atmospheric constituent concentrations. 1.
- Determine global atmospheric temperature profiles. 2.
- Determine relaxation times by measuring spatial distributions of infrared radiation from the earth's limb.

### Platform Interface Requirements:

Weight:

250 Kg

Power:

500 watts

Volume:

 $1m dia \times 3m$ 

Thermal Controls

Pointing Accuracy: ± 1min of arc.

Other:

Experimenter

Organization:

Payload #79

Mission Name: Low Light Television

### Mission Objectives:

- 1. Investigation of natural and induced auroral and airglare emissions.
- 2. Determination of global wind systems.
- 3. Measurements of excitation cross sections for atmospheric constituents.
- 4. Determination of atmospheric temperature.

### Platform interface Requirements:

Weight: 300 Kg

Power: 1000 watts

We have:  $1.0 \text{m dia} \times 2.5 \text{m}$ 

Thermal Control:

Pointing Accuracy ±1 minute of arc.

Other:

Experimenter

Organization:

Payload #80

Mission Name: Plasma Wave Injection Facility

## Mission Objectives:

- 1. Studies of wave-particle interactions.
- 2. Generation and propagation of magnetic pulsations.
- 3. Investigations of plasma instabilities.
- 4. Measurements of the electron distributions in the inner magnetosphere.
- 5. Interactions of turbulence with magnetic fields.
- 6. Acceleration of energetic particles.

### Platform Interface Requirements:

Weight: 750 Kg

Power: 5000 watts

Volume:

Thermal Control:

Pointing Accuracy: ±0.50

Other:

Experimented Organization

Payload #81

Mission Name: Microwave Sounder

### Mission Objectives:

- 1. General purpose receiving system for cm and mm wavelength emissions from the earth and sun.
- 2. Global mapping of atmospheric constituents such as precipitable water vapor.
- 3. Mapping of dispersion patterns of certain atmospheric pollutants with emission lines in the mm.
- 4. Measurements of ocean surface perturbations.

### Platform Interface Requirements:

Weight

100 Kg

Power.

200 watts

Volume

Thermal Control

Pointing Accuracy

Other:

Experiments

Organization

Payload #82

Mission Name:

Soft X-Ray Telescope

### Mission Objectives:

- 1. Simultaneous measurements of the hard and soft X-ray emission characteristics of the earth's Aurora with high spatial resolution (1 arc sec or 175 meters) and high temporal resolution (~ 1 millisecond).
- 2. Investigations of the morphology and evolution of the daytime aurora.
- 3. Investigate size and spatial distribution of electron precipitation regions.
- 4. Investigate spectra of X-ray emissions from electron precipitation regions with coarse spectral resolution.
- 5. Investigate size and motion effects in microburst precipitation.
- 6. Investigate with high time resolution temporal variations and periodicities of hard and soft X-ray emissions from microburst precipitations.
- 7. Investigate resonance scattering of plasmosphere at He<sup>+</sup> 304 A and 584 A emission from neutral helium.

#### Platform Interface Requirements:

Weight:

400 Kg

Power:

3000 watts

Volumer

 $0.5m dia \times 3.5m$ 

Thermal Control:

Pointing Accuracy

± 1 minute of arc.

Othern

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Payload #83

Mission Name: Hard X-Ray Telescope

### Mission Objectives:

See Payload #82

## Platform Interface Requirements:

Weight: Power:

Volume:

Thermal Control

Pointing Account

Other:

See Payload #82

Experimenters

Organization:

Payload #84

Mission Name: Bistatic Forward Incoherent-Scatter Radar

### Mission Objectives:

- 1. Measurement of ionospheric ion and electron temperatures, density, velocity and composition on a diurnal basis above selected transmitting sites.
- 2. Studies of natural perturbations of the medium created by current driven, drift, crossed-field or other instabilities.
- Measurements of the natural propagation of plasma irregularities by sensing transmissions from spatially separated ground-based transmitters.
- 4. Measurement of density distribution along field lines.

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## Platform Interface Requirements:

Weight:

700 Kg

Power:

100 watts

Volume:

Thermal Control:

Pointing Accuracy:

± 1.0°

Other:

Experimenter:

Organization:

APPENDIX F
PAYLOAD ASSIGNMENTS



#### APPENDIX F

#### PAYLOAD ALLOCATION

#### NOMINAL TRAFFIC MODEL

Specific payload allocations were made to all 72 platform sets (Items 1 -72) and for the individual satellite mode using the common bus (Item 145). The payload assignments to each of the platforms in each set are tabulated in Table F-1. The payload mass and power requirements for each platform bus are also tallied.

### HIGH TRAFFIC MODEL

Specific payload allocation to platform sets were made for the 12 most promising concepts (Items 73 - 84) and for the individual satellite mode (Item 148). These assignments are tabulated in Table F-2.

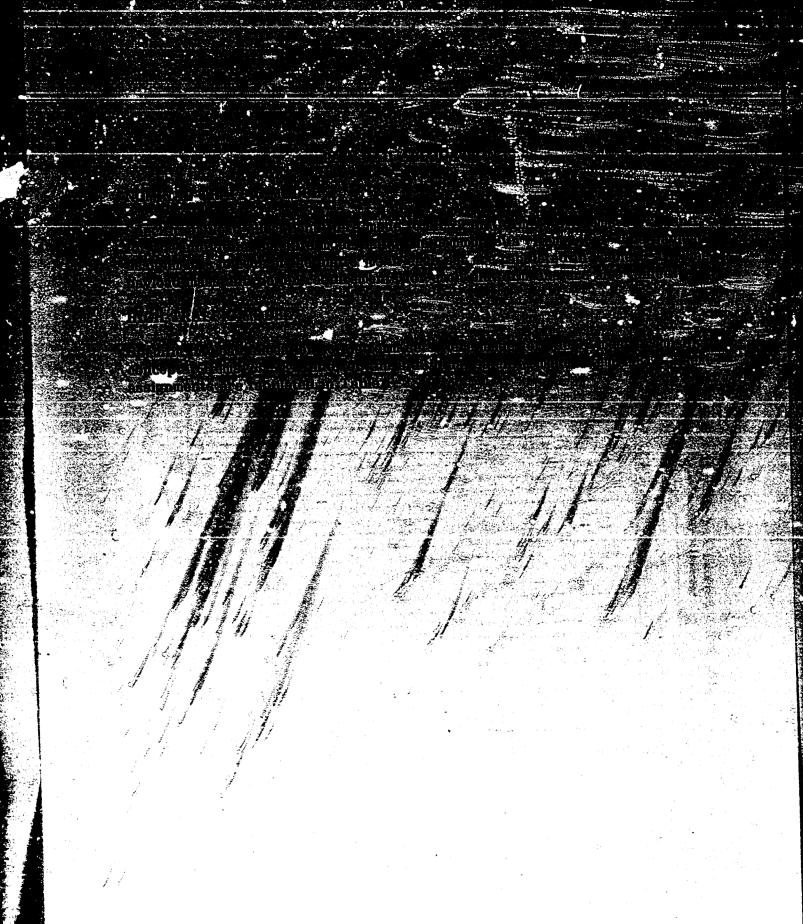


Table F-1. Payload Assignments - Nominal Traffic Model

		POWER			1300	1800	992	1450	11	51	76	512	200	300	920	200	20	370	250	330	200	400	9		•	•	_	_	_	_	_	_	_
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Table F-1. Payload Assignments - Nominal Traffic Model, Contd

			1/4	POWER.		120	200	920	920	009	2745	160	280	0001	800	1100	2100	420	150	650	550	0	•	100	•	_	_	_	_	_	_	_
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Table F-1. Payload Assignishing

Table F-1. Payload Assignments - Nominal Traffic Model, Contd

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Table F-1. Payload Assignments - Nominal Traffic Model, Contd

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Table F-1. Payload Assignments - Nominal Traffic Model, Contd

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4945

1850

1980

5540 6200 6200 5760

2000

5925 5905 5100

1419 1393 P/L MASS. by 1122 1045 1032 1161 1161 1135 1135 1161 1161 1419 1419 1406 1406 1419 1367 1367 1367 1367 1 2 3 4 5 6 7 0 9 10 11 12 17 10 19 20 27 31 32 33 34 36 41 42 43 44 51 52 53 54 58 50 71 73 75 78 78 77 78 78 78 79 50 50 SCIENCE × × × × × × × × × × × MILITARY × × × PAYLOAD ASSIGNMENTS TO PLATFORMS × × × × × × × × × ENVL. 085. × × × × × × \* \* \* \* × × × × × × × × × × × COMMUNICATIONS × × × × × × , , x х. х . . . . × × × × × PLATFORM NO. OF PLATFORMS IN SET 13 12 10 CONCEPT NO. 53cC Contd 37pC' 54bC' 36rC' NO. 80 91 15 11

Table F-1. Payload Assignments - Nominal Traffic Model, Contd

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Table F-1. Payload Assignments - Nominal Traffic Model, Contd

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Table F-1. Payload Assignments - Nominal Traffic Model, Contd LOCATION(S): (3W '1EMISPHERE; | TALLANTIC

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Table F-1. Payload Assignments - Nominal Traffic Model, Contd

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Table F-2. Payload Assignments - High Traffic Model

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Figure F-2. Payload Assignments - High Traffic Model, Contd

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7.			1,354	1,612		1.703	1,703	1.677	1,677	1,619	1,651	1,703	1,677	1,638	1.484	516	1,664	1,638	1,703	1,548	2,051	2,064	2,090	1,974	2.064	1,793	1.806	1.419	2,012	2,077	2.077
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Table F-2. Payload Assignments - High Traffic Model, Contd

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Table F-2. Payload Assignments - High Traffic Model, Contd

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Table F-2. Payload Assignments - High Traffic Model, Contd

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Table F-2. Payload Assignments - High Traffic Model, Contd

250 1.000 330 2.000 330 2.000 350 50 200 50 200 350 201 120 PAYLOAD ASSIGNMENTS TO PLATFORMS LOCATIONISI. (3W. HEMISPHERE, (3 ATLANTIC × × ×× PLATFORM NUMBERS 149 150, 151 152-155 159-163 158 NO OF PLATFORMS IN SET 163 CUNCEPT Attantac 71sB Contd ITEM NO 148

APPENDIX G
PLATFORM SYNTHESIS

### APPENDIX G

## PLATFORM SYNTHESIS

Parametric platform design concepts were developed for each of 72 sets for Mission Sets N and V. For each set, a standard platform bus was parametrically designed to accommodate the maximum weight and maximum power requirements of each payload group. Based upon payload weight and power requirements, the platform structure and supporting subsystems were sized, taking into account redundancy and modularity appropriate for each operational mode. The structural weight estimates included the impact of high T/W ratios. Then the total platform weight, including payloads, was calculated and a 15% contingency factor included.

The parametric platform designs were developed using scaling factors and weight estimating relationships developed from the preliminary trade studies for each of the operational modes. A series of point designs were developed that spanned a wide range of payload mass and power support requirements for each of the 4 candidate operational modes. These designs were then used to develop scaling factors for synthesizing the 144 platform sets used in the basic system trade studies. These scaling factors are listed in Table G-1.

These scaling factors were then used to set up a platform synthesis model to define the parametric platform designs. A set of data sheets was developed for each operational mode which contains all of the mass and power estimating relationships for the platform structure and subsystems. The data sheets employ the previously defined scaling factors plus a 15% contingency factor to estimate platform mass and power as a function of payload mass and power.

Table G-2 contains the platform mass and power estimating data sheets for the 144 platform system concepts that were developed for Buildup Mode K.

Table G-1. Platform Subsystem Scaling Factors

Parameter	Oper. Mode	Mass Range, kg	Equation $(Y = mx + b)$
Structure Mass* (M <sub>s</sub> )	В	$ m M_{PY}~^{\geq}~2200$	$M_{\rm S}=0.29~M_{ m PY}$ + 300 kg
(*Does not include mass penalty for high T/W ratio)	В	$M_{\mathbf{PY}}~<~2200$	$M_{\rm S} = 0.396  M_{\rm PY} + 50  \rm kg$
	c, c¹	$\rm M_{\rm PY}~\stackrel{>}{\scriptstyle >}~3000$	$M_S = 0.225 M_{PY} + 300 kg$
	c, c¹	$M_{\rm PY}~<~3000$	$M_{\rm S} = 0.31  M_{\rm PY} + 50  \rm kg$
	ш	$M_{\rm PY}~\stackrel{>}{\scriptscriptstyle \sim}~2700$	$M_{\rm S} = 0.259  M_{\rm PY} + 300  \rm kg$
	ы	$M_{PY}~<~2700$	$M_{\rm S} = 0.35 M_{\rm PY} + 50 \text{ kg}$
TCC Mass $(M_{\mathrm{T}})$	В	$M_{\mathbf{PY}} \geq 4400$	$M_{\rm T} = 0.026 M_{\rm PY} + 60 \text{ kg}$
	В	$M_{ m PY}$ < 4400	$M_{\mathrm{T}}$ = 0.0306 $M_{\mathrm{PY}}$ + 40 kg
	c, c'	$M_{\mathbf{PY}} \geq 4400$	$M_{\rm T}=0.0263~M_{\rm PY}+77~\rm kg$
	c, c'	$M_{ m PY}$ < 4400	$M_{\mathrm{T}}$ = 0.0319 $M_{\mathrm{PY}}$ + 52 kg
	ы	$M_{\mathbf{PY}} \geq 4400$	$M_{\rm T}=0.0262~M_{\rm PY}+68~{\rm kg}$
	ы	$M_{\rm PY}~<~4400$	$M_{\rm T} = 0.0317 \; M_{\rm PY} + 45 \; {\rm kg}$
TCS Mass (M <sub>H</sub> )	В	All	$M_{\rm H} = 0.0175  M_{\rm PY} + 40  {\rm kg}$
	c, c,	All	$M_{\rm H} = 0.0175 \; M_{\rm PY} + 52 \; {\rm kg}$
	ы	All	$M_{\rm H} = 0.0175  M_{\rm PY} + 45  \rm kg$

G-3

Table G-1. Platform Subsystem Scaling Factors, Contd

		Mass	
	Oper.	Range,	Equation
Parameter	Mode	kg	(Y = mx + b)
Rendezvous and Docking Mass (MRD)	E	$M_{ extbf{PY}}  \stackrel{>}{\scriptscriptstyle \sim}  2600$	$M_{RD} = 0.0388 M_{PY} + 400 kg$
"RD'	E	$M_{ extbf{PY}}$ < 2600	$M_{RD} = 0.1175 M_{PY} + 200 kg$
	C'	All	$M_{RD} = 0.0193 M_{PY} + 200 kg$
EPS Mass (M <sub>E</sub> )	В	All	$M_E = 0.055 P_O + 187 kg$
	C	All	$M_{E} = 0.0713 P_{O} + 240 kg$
	E	All	$M_{E} = 0.0620 P_{O} + 210 kg$
	C'	All	$M_{E} = 0.0609 P_{O} + 200 kg$
ACS Mass (MA)	В	All	$M_{A} = 0.0228 M_{PL} + 50 kg$
	C, C'	All	$M_{A} = 0.0294 M_{PL} + 64 kg$
	Е	All	$M_A = 0.0258 M_{PL} + 56 kg$
EPS Power Losses and Battery Charge (P <sub>E</sub> )	All	All	$P_{E} = 0.067 P_{O} + 100 W$
ACS Power (PA)	All	All	$P_{A} = 0.011 M_{PL} + 30 W$
RCS Power (P <sub>R</sub> )	All	All	$P_{\mathbf{R}} = 0.008  M_{\mathbf{PY}} + 20  \mathbf{W}$
TCC Power (P <sub>T</sub> )	All	All	$P_{T} = 0.0195 M_{PY} + 40 W$

Table G-1. Platform Subsystem Scaling Factors, Contd

		Mass	
	Oper.	Range,	Equation
Parameter	Mode	kg	(Y = mx + b)
CCS Power (P <sub>H</sub> )	All	All	$P_{H} = 0.0438 M_{PY} + 100 W$
Rendezvous and Docking Equipment Power (P <sub>RD</sub> )	E, C'	All	$P_{RD} = 200 W$
RCS Dry Weight (M <sub>R</sub> )	All	All	$M_{\mathbf{R}} = 0.2 M_{\mathbf{P}}$
Propellant Mass (M <sub>p</sub> )	В	All	$M_{\mathbf{P}} = 0.1660 M_{\mathbf{PL}}$
	C	All	$M_{\mathbf{P}} = 0.3320  M_{\mathbf{PL}}$
	C'	All	$M_{\mathbf{P}} = 0.1660 M_{\mathbf{PL}}$
	E	All	$M_{\mathbf{P}} = 0.0623 M_{\mathbf{PL}}$

 $P_{O} = EPS Output Power, watts$ 

 $<sup>\</sup>mathrm{M}_{\mathrm{PL}}$  = Platform Mass, kg

Table G-2. Platform Mass and Power Estimating Data Sheets

OTV: OTV, L.T. Reusable OPER, MODE: C - Non-serviced, 16 year life

Mass kg	Power, watts	Estimating Basis	Platform Elements	
322	1,800	Item: 1 Case: II $(M_{py} < 3000)$	Payload Equipment	1.
165	0	$M_S = 0.31 (M_{PY}) + 50 = 150 kg$	Structure - Basic	2.
		$10\% \text{ of } M_S = 15 \text{ kg}$	- Secondary	
		T/W = 0.13: Penalty = 0 kg	- T/W Penalty	
430		$M_E = 0.0713 (P_O) + 240 = 430 \text{ kg}$	EPS	3.
	279	$P_{E} = 0.067 (P_{O}) + 100 = 279 W$		
137		$M_A = 0.0294 \ (M_{PL}) + 64 = 137 \ kg$	ACS	4.
	57	$P_A = 0.011 (M_{PL}) + 30 = 57 W$		
990		$M_p = 1.2 (M_p) = 1.2 \times (825) = 990 \text{ kg}$	$RCS M_{p} = 0.332 (M_{PL})$	5.
	23	$P_{R} = 0.008  (M_{PY}) + 20 = 23  W$	$M_{\mathbf{R}} = M_{\mathbf{P}} + 0.2 M_{\mathbf{P}}$	
		$(M_{PY} < 4400)$		
56		$M_T = 0.0319 (M_{PY}) + 52 = 56 \text{ kg}$	ICC	6.
	46	$P_T = 0.0195 (M_{PY}) + 40 = 46 W$		
58		$M_{H} = 0.0175  (M_{PY}) + 52 = 58  kg$	TCS	7.
	114	$P_{H} = 0.0438  (M_{PY}) + 100 = 114  W$		
N/A_	N/A	N/A	Rendezvous and Docking	8.
2,158	2,319	Sub Tot		
324	348	15% of the above power and mass	Contingency and Integration	9.
M <sub>PL</sub> 2,482	Po			
		TOTA	OF PLATFORMS: 67	NO.

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PLATFORM NO. 319C

OTV, Reusable OTV:

	Mass, kg	439	352		487		162		1,328		22		09		N/A	2,894	434	Mpt	3,328	
. 16 year life	Power, watts	2,420	0			332		19		00) 24		49		119	N/A	3,009	451	a.		
OPER. MODE: C - Non-serviced, 16 year life	Estimating Basis	Item: 2 Case: II (M <sub>PV</sub> < 3000)	$M_{\rm S} = 0.31  (M_{\rm PY}) + 50 = 186  \text{kg}$	T/W = 1.08; Penalty = 147 kg	$M_{\rm F} = 0.0713 \; (P_{_{\rm O}}) + 249 = 487 \; {\rm kg}$	$P_{E} = 0.067 (P_{o}) + 100 = 332 W$		$P_A = 0.011  (M_{PL}) + 30 = 67  W$	$M_{\rm B} = 1.2  (M_{\rm p}) = 1.2  \times (1106) = 1328  \text{kg}$	$P_{R} = 0.008 \text{ (M}_{PY}) + 20 = 24 \text{ W} \text{ (M}_{PY} < 4400)$		$P_{T} = 6.0195  (M_{PY}) + 40 = 49  W$	$M_{H} = 0.0175  (M_{PY}) + 52 = 60  \text{kg}$		N/A	Sub Tot	15% of the above power and mass		TOTALS:	
OTV: OTV, Reusable	Platform Elements	1. Payload Equipment	2. Structure - Basic - Secondary	- T/W Penalty	3. EFS		4. ACS		5. RCS $M_D = 0.332  (M_{PL})$	$M_{R} = M_{P} + 0.2 M_{P}$	6. TCC		7. TCS		8. Rendezvous and Docking		9. Contingency and Integration		NO. OF PLATFORMS: 39	

	0.1	OTV: OTV, L.T. Reusable	C' - Non-serviced, 16 year life, OPER. MODE: consumables replenished at 8 year	PLA' ced, 16 y plenished	PLATFORM NO. 16 year life, thed at 8 years	52aC'
		Platform Elements	Estimating Basis		Power,	Mass,
	1	1. Payload Equipment	Item: 3 Case: II (M / augo)			N. C.
	2	2. Structure - Basic			4,000	516
			$_{\rm S}^{\rm M} = 0.31  ({\rm M}_{\rm PY}) + 50 = 210  {\rm kg}$		<b>C</b> 6	231
		- Seconda.y	$10\% \text{ of M}_{S} = 21 \text{ kg}$			
		- T/W Penalty	T/W = 0.13; Penalty - 0 kg	7		
	3	. EPS	$M_{ m F} = 0.0609 \; (P_{ m o}) + 200 = 546 \; { m kg}$			
	,		$P_{E} = 0.067 (P_{O}) + 100 = 480 W$		480	246
G-	4	ACS	$M_A = 0.0294  (M_{PL}) + 64 = 142  \text{kg}$			140
8			$P_A = 0.011 \text{ (M}_{PL}) + 30 = 59 \text{ W}$		59	747
	5.	RCS	$M_{\rm P} = 1.2  (M_{\rm D}) = 1.2 \times (440) = 528  \text{kg}$		3	
			$\frac{P}{P} = 0.008 \text{ (M}_{DV}) + 20 = 24 \text{ W (M} < 4400)$	400)		228
	9.	TCC				
			$P_{\perp} = 0.0195  (M_{\odot}) + 40 - 50  m$			89
	7.	TCS	T		20	
			P-pres			61
	a		$^{P}_{H} = 0.0438 \; (M_{PY}) + 100 = 123 \; W$		123	
	0	rendervous and Docking	$^{M}_{RD}$ = 0.6193 ( $^{M}_{PY}$ ) + 200 = 210 kg			910
			$^{P}_{\mathrm{RD}}=200~\mathrm{W}$		200	
	6	Contingency and 124	Sub Tot	4,	4,936	2,301
		and megration	15% of the above power and mass		740	345
	10.	NO. OF PLATFORMS: 31	TOTALS	_	P M	$^{ m M}_{ m PL}$
						2.646

OTV: Centaur, Expendable

OPER. MODE: C - Non-serviced, 16 year life

	Platform Elements	Estimating Basis	Power, watts	Mass, kg
1.	Payload Equipment	Item: 4 Case: II (M <sub>PY</sub> < 3000)	4,100	684
2.	Structure - Basic	$M_{S} = 0.31 \ (M_{PY}) + 50 = 262 \ kg$	0	688
	- Secondary	10% of M <sub>S</sub> = $26$ kg		
	- T/W Penalty	T/W = 1.76; Penalty = 400 kg		
3.	EPS	$M_E = 0.0713 (P_O) + 240 = 639 kg$		639
		$P_{E} = 0.067 (P_{O}) + 100 = 475 W$	475	
4.	ACS	$M_A = 0.0294 \ (M_{PL}) + 64 = 212 \ kg$		212
		$P_A = 0.011 \ (M_{PL}) + 30 = 85 \ W$	85	
5.	$RCS M_{p} = 0.332 (M_{PL})$	$M_{R} = 1.2 (M_{p}) = 1.2 \times (1666) = 1999 \text{ kg}$		1,999
	$M_{R} = M_{P} + 0.2 M_{P}$	$P_{R} = 0.008  (M_{PY}) + 20 = 25  W$	25	
		$(M_{PY} < 4400)$		
6.	TCC	$M_{T} = 0.0319  (M_{PY}) + 52 = 74  kg$		74
		$P_{T} = 0.0195 \ (M_{PY}) + 40 = 53 \ W$	53	
7.	TCS	$M_{H} = 0.0175  (M_{PY}) + 52 = 64  kg$		64
		$P_{H} = 0.0438  (M_{PY}) + 100 = 130  W$	130	
8.	Rendezvous and Docking	N/A	N/A	N/A
		Sub Tot	4,869	4,360
9.	Contingency and Integration	15% of the above power and mass	730	654
NO.	OF PLATFORMS: 26	TOTALS	P O : 5,6900	M <sub>PL</sub> 5,014

PLATFORM MASS & POWER ESTIMATES

Reusable
L.T.
OTV: OTV,

V: OTV	OTV: OTV, L.T. Reusable	OPER. MODE: E-Serviced, 16 vr li	PLATFORM NO. 33aE	33aE
		am if or	o yr consur	nables supply
Platform	Platform Elements	Estimating Basis	Power,	Mass,
Structure	s ayloud Equipment Structure - Basic	Item: 5 Case: II (M <sub>PY</sub> < 2700)	4,105	675
	- Secondary	$_{ m S}^{ m M} = 0.35 \; ({ m M}_{ m PY}) \; + \; 50 = 286 \; { m kg}$ $10\% \; { m of} \; { m M}_{ m S} = 29 \; { m kg}$	0	315
EPS	- T/W Penalty	$T/W = 0.13$ ; Penalty = 0 kg $M_{\rm F} = 0.0620 \text{ (P)} + 210 = 571 \text{ kg}$		
ACS		$P_{E} = 0.067 (P_{O}) + 100 = 490 W$	490	571
				124
RCS M <sub>P</sub>	$= 0.0623  (M_{ m PL})$	$^{L}A=0.011~(M_{ m PL})+30=59~W$ $M_{ m R}=0.2~(M_{ m D})+1.2~ imes (164)=197~k\sigma$	59	
MR TCC	$= M_{\rm P} + 0.2 M_{\rm P}$	$P_{R} = 0.008 (M_{PY}) + 20 = 25 W (M_{PY} < 4400)$ $M = 0.0317 (M_{PY})$	25	197
0		$T = 0.0195 \text{ (M}_{DV}) + 45 = 66 \text{ kg}$ $P_T = 0.0195 \text{ (M}_{DV}) + 40 = 53 \text{ W}$	ć L	99
I CS		$M_{H} = 0.0175  (M_{PY}) + 45 = 57  \text{kg}$	50	Ę
endezvou	Rendezvous and Docking	$_{ m H}^{ m P} = 0.0438 \; ({ m M}_{ m PY}) + 100 = 130 \; { m W} \; ({ m M}_{ m PY} < 2600)$	130	25
		$^{R}$ D $^{O}$ : 1113 ( $^{M}$ PY) + 200 = 279 kg		279
			200	
ontingenc	Contingency and Integration	b Tot	5,062	2,284
	1	to a tile above power and mass	759	343
NO. OF PLATFORMS:	IRMS: 19	P O TOTALS: 5.	821	M <sub>PL</sub>
				070

G-10

PLATFORM MASS & POWER ESTIMATES	ATES	PLATFORM NO.	). 33kC
OTV: OTV, Reusable	OPER. MODE: C-Non-serviced, 16 year life	16 year life	
Platform Elements	Estimating Basis	Power,	Mass, kg
1. Payload Equipment	Item: 6 Case: III (M < 3C90)	4.105	77.4
2. Structure - Basic	$M = 0.31  (M_{\odot}) + 50 = 281  \text{kg}$		799
- Secondary	$_{10\%}$ of $_{\rm M}$ = 28 kg	,	1
- T/W Penalty	T/W = 0.78; Penalty = 413 kg		
3. EPS	$M_{E} = 0.0713 (P_{o}) + 240 = 641 \text{ kg}$		641
	$P_{\rm E} = 0.067 \; (P_{\rm o}) + 100 = 476 \; W$	476	
4. ACS	$M_A = 0.0294  (M_{PL}) + 64 = 220  \text{kg}$		220
	$P_A = 0.011  (M_{PL}) + 30 = 88  \text{W}$	88	
5. RCS $M_{\rm P} = 0.332  (M_{\rm PL})$	$M_{\rm R} = 1.2  (M_{\rm p}) = 1.2  \times (1764) = 2117  \text{kg}$		2,117
$M_{\mathbf{R}} = M_{\mathbf{P}} + 0.2 M_{\mathbf{P}}$	$P_{R} = 0.008  (M_{PY}) + 20 = 26  W$	26	
	$(M_{PX} < 4400)$		
6. TCC	$M_T = 0.0319 \; (M_{PY}) + 52 = 77 \; kg$		7.7
	$P_{T} = 0.0195  (M_{PY}) + 40 = 55  W$	55	
7. TCS			99
	11	134	
8. Rendezvous and Docking	N/A	N/A	N/A
	Sub Tot	4,885	4,616
9. Contingency and Integration	15% of the above power and mass	733	692
NO. OF PLATFORMS: 19	TOTALS:	P. 5,617	$^{ m M_{PL}}_{5.309}$
		1	

ATFORM MASS & FOWER ESTI-

OPER. MODE: replenished at 8 years

_	OTV:	v. OTV, Reusable	OPER, MODE: replenished at 8 years		
				Power,	Mass,
		Platform Elements	Estimating Basis	watts	kg
	-	Davload Equipment	Item: 7 Case: II (M <sub>DV</sub> < 3000)	4,105	774
	. 2		$M_g = 0.31 \text{ (M}_{PY}) + 50 = 290 \text{ kg}$	0	466
		- Secondary	$109 \text{ of M}_{S} = 29 \text{ kg}$		
		- T/W Penalty	T/W = 1.08; Penalty = 147 kg		
	3	EPS	$M_E = 0.0609 (P_O) + 200 = 556 \text{ kg}$		556
			$P_{\rm E} = 0.067 \ (P_{\rm A}) + 100 = 491 \ W$	491	
	4	ACS	$M_A = 0.0294 \text{ (M}_{PL}) + 64 = 166 \text{ kg}$		166
G-:				89	
12	5	$BCS M_{2} = 0.166 (M_{22})$	$M_{\rm D} = 1.2  (M_{\rm D}) = 1.2  \times (575) = 690  \text{kg}$		069
	,		$P_{\rm R} = 0.008  (M_{\rm PY}) + 20 = 26  \text{W}  (M_{\rm PY} < 4400)$	26	
	9	TCC	$M_T = 0.0319  (M_{PV}) + 52 = 77  \text{kg}$		77
			$P_T = 0.0195  (M_{PY}) + 40 = 55  W$	55	
	7	TCS	$M_{LJ} = 0.0175  (M_{PV}) + 52 = 66  \text{kg}$		99
			$P_{LI} = 0.0438 \text{ (M}_{PV}) + 100 = 134 \text{ W}$	134	
	00	Rendezvous and Docking	$M_{PP} = 0.0193 \text{ (M}_{PY}) + 200 = 215 \text{ kg}$		215
			$P_{\text{max}} = 200 \text{ W}$	200	
			RD Sub Tot	5,079	3,008
	0	Continue on Integration	15% of the above power and mass	762	451
	, ,			Ьо	$^{ m M_{PL}}$
	-	19 OF BLATFORMS: 19	TOTALS:	5,841	3,460
	Z				

OTV, L.T. Reusable	OPEK, MODE: Dower Mass,	Dower	Mass,
	Estimating Basis	watts	
Platform Elements	(M < 2200)	4,200	069
Payload Equipment		0	356
Structure - Basic	$M_{\rm s} = 0.396  (M_{\rm pY}) + 30 = 323  {\rm rs}$		
- Secondary	108  of M = 32  kg		
- T/W Penalty	T/W = 0.13; Penalty = 0 Kg		200
EPS	$M_E = 0.055 (P_O) + 187 = 500 Rg$	481	
	$P_{E} = 0.067 (P_{O}) + 100 = 401 \text{ m}$ $E = 0.067 (P_{O}) + 100 = 401 \text{ m}$		110
ACS	-	59	
	$P_{A} = 0.011 \text{ (mpL)}$ . 35		527
$RCS M_{\rm p} = 0.166 (M_{\rm pL})$		26	
$M_{R} = M_{P} + 0.2 M_{P}$	$(M_{DV} < 4400)$		
	$M_{\pi} = 0.0306  (M_{PV}) + 40 = 61  \text{kg}$	;	
TCC	$P_{rr} = 0.0195 \text{ (M}_{PY}) + 40 = 53 \text{ W}$	53	
	$M_{\star\star} = 0.0175  (M_{PV}) + 40 = 52  \text{kg}$	,	
7. TCS	$p = 0.0438  (M_{EG}) + 100 = 130  W$	130	
		N/A	N/A
8. Rendezvous and Docking	N/A Sub Tot	4,949	2,296
	Show Providence	742	
9. Contingency and Integration	ion 15% of the above power and mass	Po	$M_{PL}$
	.8.14 #0.5		2,640

FLAI FORM MASS & LONEIN ESTIMITE		16 year life	
OTV: Centaur, L.T. Expendable	endable OPER. MODE: C - Non-serviced, 16 year life	, to year me	
Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Payload Equipment	Item: 9 Case: II (M <sub>DV</sub> < 300¢)	4,200	890
2. Structure - Basic	$M_g = 0.31  (M_{p,Y}) + 50 = 326  \text{kg}$	0	358
- Secondary	10% of M <sub>S</sub> = 33 kg		
- T/W Penalty			
3. EPS	$M_{\rm F} = 0.0713~({\rm P_{_{\rm O}}}) + 240 = 649~{\rm kg}$		649
	$P_{E} = 0.067 (P_{A}) + 100 = 484 W$	484	
4. ACS	$M_{\star} = 0.0294  (M_{DI}) + 64 = 205  \text{kg}$		205
	$P_A = 0.011 \text{ (M}_{DI}) 30 = 83 \text{ W}$	83	
5. RCS $M_{\rm S} = 0.332  (M_{\rm DY})$	$M_{D} = 1.2  (M_{D}) = 1.2  \times (1589) = 1907  \text{kg}$		1,907
$M_{\mathbf{R}} = M_{\mathbf{P}} + 0.2 M_{\mathbf{P}}$	P. R.	27	
4			
6. TCC	$M_T = 0.0319  (M_{PV}) + 52 = 80  \text{kg}$		80
	$P_{Tr} = 0.0195 \text{ (M}_{DV}) + 40 = 57 \text{ W}$	22	
7. TCS	$M_{H} = 0.0175  (M_{PV}) + 52 = 68  \text{kg}$		89
	11	139	
8. Rendezvous and Docking	'Z	N/A	N/A
	Sub Tot	4,990	4,159
9 Contingency and Integration	ration 15% of the above power and mass	749	623
		ч°	$M_{\mathrm{PL}}$
NO OF PLATFORMS: 16	TOTALS:	3: 5,739	4,780

PLATFORM NO. 34fC

OPER. MODE: C - Non-serviced, 16 year life IOTV, Expendable OTV:\_\_\_

		Platform Elements	Estimating Basis	Power, watts	Mass, kg
	1.	Payload Equipment	Item: 10 Case: II (M <sub>PV</sub> < 3000)	4,200	890
	2.	Structure - Basic	$M_S = 0.31  (M_{PY}) + 50 = 326  kg$	0	806
		- Secondary	10% of M = 33 kg		
		- T/W Penalty	T/W = 0.69; Penalty = 448 kg		
	3.	EPS	$M_{E} = 0.0713 (P_{O}) + 240 = 650 \text{ kg}$		650
			$P_{E} = 0.067 (P_{O}) + 100 = 485 W$	485	
0	4.	ACS ·	$M_A = 0.0294 (M_{PL}) + 64 = 234 \text{ kg}$		234
G-15			$P_A = 0.011 \ (M_{PL}) + 30 = 94 \ W$	94	
	5.	$RCS M_{p} = 0.332 (M_{PL})$	$M_{R} = 1.2 (M_{p}) = 1.2 \times (1925) = 2310 \text{ kg}$		2,310
		$R_{R} = M_{P+} 0.2 M_{P}$	$P_{R} = 0.008  (M_{PY}) + 20 = 27  W  (M_{PY} < 4400)$	27	
	6.	TCC	$M_{T} = 0.0319 (M_{PY}) + 52 = 80 \text{ kg}$		80
			$P_{T} = 0.0195 \ (M_{PY}) + 40 = 57 \ W$	57	
	7.	TCS	$M_{H} = 0.0175  (M_{PY}) + 52 = 68  kg$		68
			$P_{H} = 0.0438  (M_{PY}) + 100 = 139  W$	139	
	8.	Rendezvous and Docking	N/A	N/A	N/A
			Sub Tot	5,002	5,039
	9.	Contingency and Integration	15% of the above power and mass	750	756
				P	$M_{ m PL}$
	NO.	OF PLATFORMS: 16	TOTALS:	5,752	5,795

OTV: OTV, Reusable

OPER. MODE: E-serviced, 16 yr life, 3 yr consumables supply

	Platform Elements	Estimating Basis	Power, watts	Mass, kg
1.	Payload Equipment	Item: 11 Case: II (Mpy < 2700)	4,230	866
2.	Structure - Basic	$M_g = 0.35  (M_{PV}) + 50 = 318  \text{kg}$	0	497
	- Secondary	10% of M = 32 kg		
	- T/W Penalty	T/W = 108; Penalty = 147 kg		
3.	EPS	$M_{E} = 0.0620 \text{ (P}_{O}) + 210 = 528 \text{ kg}$		582
		$P_{E} = 0.067 (P_{O}) + 100 = 502 W$	502	
4.	ACS	$M_A = 0.0258  (M_{PL}) + 56 = 138  \text{kg}$		138
		$P_A = 0.011 \ (M_{PL}) + 30 = 65 \ W$	65	
5.	$RCS M_{\mathbf{p}} = 0.0623 (M_{\mathbf{pL}})$	$M_R = 1.2 (M_p) + 1.2 \times (197) = 237 \text{ kg}$		237
	$M_{R} = M_{P} + 0.2 M_{P}$	$P_{R} = 0.008  (M_{PY}) + 20 = 27  W  (M_{PY} < 4400)$	27	
6.	TCC	$M_T = 0.0317 (M_{PY}) + 45 = 72 \text{ kg}$		72
		$P_{T} = 0.0195 (M_{PY}) + 40 = 57 W$	57	
7.	TCS	$M_{H} = 0.0175 (M_{PY}) + 45 = 60 \text{ kg}$		60
		$P_{H} = 0.0438  (M_{PY}) + 100 = 138  W  (M_{PY} < 20)$	600) 138	
8.	Rendezvous and Docking	$M_{RD} = 0.1175 \ (M_{PY}) + 200 = 302 \ kg$		302
		$P_{RD} = 200 W$	200	
		Sub Tot	5,219	2,754
9.	Contingency and Integration	15% of the above power and mass	783	413
			Po	$^{ m M}_{ m PL}$
NO	. OF PLATFORMS: 15	TOTALS:	6,002	3,167

Ь	PLATFORM MASS & POWER ESTIMATES	TES	PLATFORM NO	NO 55vC
0	OTV: 4 STG IUS (2L,2L)	OPER. MODE: C-Non-serviced, 16 year life	, 16 year life	
-	Platform Elements	Estimating Basis	Power,	Mass,
1	. Payload Equipment	Item: 12 Case: III (M <sub>r.y.</sub> < 3000)	4.230	903
2.	. Structure - Basic	$M_S = 0.31  (M_{DV}) + 50 = 358  \text{kg}$	0	1.251
	- Secondary	$108 \text{ of M}_{\text{g}} = 36 \text{ kg}$		
	- T/W Penalty	T/W = 1.93; Penalty = 857 kg		
e-j	. EPS	$M_{E} = 0.0713 (P_{o}) + 240 = 655 \text{ kg}$		655
		$P_{E} = 0.067 \ (P_{O}) + 100 = 490 \ W$	490	
4.	. ACS	$M_A = 0.0294 \ (M_{PL}) + 64 = 272 \ kg$		272
		$P_{A} = 0.011  (M_{PL}) + 30 = 108  W$	108	
2.	RCS M <sub>P</sub>	$M_R = 1.2  (M_p) = 1.2 \times (2344) = 2812  kg$		2,812
	$M_{\mathbf{R}} = M_{\mathbf{P}} + 0.2 M_{\mathbf{P}}$	$P_{R} = 0.008 \ (M_{PY}) + 20 = 28 \ W$	28	
		$(M_{PY} < 4400)$		
9	TCC	$M_{T} = 0.0319 \ (M_{PY}) + 52 = 84 \ kg$		84
t		$P_{T} = 0.0195  (M_{PY}) + 40 = 59  W$	59	
7.	TCS	11		69
		$_{ m H}^{ m P} = 0.0438 \; ({ m M}_{ m PY}) \; + \; 100 \; = \; 143 \; { m W}$	143	
× ×	Rendezvous and Docking	N/A	N/A	N/A
•		Sub Tot	5,057	6,136
9.	Contingency and Integration	15% of the above power and mass	759	920
			ч°	$^{M}_{PL}$
NO	NO. OF PLATFORMS: 15	TOTALS:	LS: 5,816	7,056

PLA	PLATFORM MASS & POWER ESTIMATES		PLATFORM	PLATFORM NO. 35qB
OTV:	V: OTV, Reusable	OPER. MODE: B - Non-serviced, 8 year life, replaced	8 year life	replaced
			Power,	Mass,
	Platform Elements	Estimating Basis	watts	Kg
1.	Payload Equipment	Item: 13 Case: II ( $M_{\mathrm{PY}}$ < 2200)	4,900	098
2.	Structure - Basic	$M_{\rm S} = 0.396  (M_{\rm PY}) + 50 = 391  {\rm kg}$	0	577
	- Secondary	$10\%$ of $M_S = 39$ kg		
	- T/W Penalty	T/W = 1.08; Penalty = 147 kg		
3.	EPS	$M_{E} = 0.055 (P_{o}) + 187 = 549 \text{ kg}$		549
		$P_{E} = 0.067 (P_{O}) + 100 = 541 W$	541	
4.	ACS	$M_A = 0.0228 \ (M_{PL}) + 50 = 126 \ kg$		126
		$P_A = 0.011  (M_{PL}) + 30 = 67  W$	29	
5.	RCS $M_p = 0.166  (M_{PL})$	$M_R = 1.2 (M_P) + 1.2 \times (554) = 665 \text{ kg}$		999
	$N_{\mathbf{R}} = M_{\mathbf{P}} + 0.2 M_{\mathbf{P}}$	$P_{R} = 0.008 \; (M_{PY}) + 20 = 27 \; W$	27	
		$(M_{ m PY}$ < 4400)		
9.	TCC	$M_{\rm T} = 0.0306 \; (M_{ m py}) + 40 = 66 \; { m kg}$		99
	×	$P_{T} = 0.0195 \; (M_{pY}) + 40 = 57 \; W$	2.4	
7.	TCS	$M_{H} = 0.0175  (M_{PY}) + 40 = 55  \text{kg}$		55
		$P_{H} = 0.0438 \; (M_{PY}) + 100 = 138 \; W$	138	
8	Rendezvous and Docking	N/A	N/A	N/A
		Sub Total	5,729	2,898
9.	Contingency and Integration	15% of the above power and mass	829	435
			ч о	$^{ m M_{PL}}$
NO	NO. OF PLATFORMS: 14	TOTALS:	6,588	3,333

PLATFORM NO. 35eC

OTV: OTV, Expendable OPER. MODE: C - Non-serviced, 16 year life

	Platform Elements	Estimating Basis	Power, watts	Mass, kg
1.	Payload Equipment	Item: 14 Case: II (M <sub>PY</sub> < 3000)	4,900	1,109
2.	Structure Basic	$M_g = 0.31  (M_{py}) + 50 = 394  kg$	0	925
	- Secondary	10% of M = 39 kg		
1	- T/W Penalty	T/W = 0.64; Penalty = 492 kg		
3.	EPS	$M_{\rm F} = 0.0713  (P_{\rm O}) + 240 = 715  \rm kg$		715
		$P_E = 0.067 (P_O) + 100 = 546 W$	546	
4.	ACS	$M_A = 0.0294 \ (M_{PL}) + 64 = 262 \ kg$		262
		$P_A = 0.011 (M_{PL}) + 30 = 104 W$	104	
j.	RCS $M_{p} = 0.232 \ (M_{pL})$	$M_{R} = 1.2 (M_{p}) = 1.2 \times (2235) - 2682 \text{ kg}$		2,682
	$M_{R} = M_{p} + 0.2 M_{p}$	$P_{R} = 0.008  (M_{PY}) + 20 = 29  W  (M_{PY} < 4400)$	29	
ò.	TCC	$M_{T} = 0.0319 (M_{PY}) + 62 = 87 kg$		87
		$P_{T} = 0.0195 \ (M_{PY}) + 40 = 62 \ W$	62	
7.	TCS	$M_{H} = 0.0175 (M_{PY}) + 52 = 71 \text{ kg}$		71
		$P_{H} = 0.0438  (M_{PY}) + 100 = 149  W$	149	
8.	Rendezvous and Docking	N/A	N/A	N/A
		Sub Tot	5,788	5,852
9.	Contingency and Integration	15% of the above power and mass	868	878
			Po	$^{ m M}_{ m PL}$
10	OF PLATFORMS: 14	TOTALS:	6,657	6,730

	IOTV, L.T. Expendable	OPER, MODE: C NOI SELVICES, CO.		
7 10		Retimating Basis	Power,	Mass, kg
	Platform Elements	a contract of the contract of		
	Pavload Equipment	Item: 15 Case: II (Mpy < 3000)	4,700	1,109
	Structure - Basic	$M_{\rm S} = 0.31 \; (M_{\rm PY}) + 50 = 394 \; {\rm kg}$	0	433
	- Secondary	$108 \text{ of M}_{S} = 39 \text{ kg}$		
	- T/W Penalty	T/W = 0.08; Penalty = 0 kg		
	Sqa	$M_{\odot} = 0.0713 (P_{\odot}) + 240 = 696 \text{ kg}$		969
	E C	$P_{\perp} = 0.067 \text{ (P_{\perp})} + 100 = 528 \text{ W}$	528	
	ŭ C			228
	ACS	₫	91	*
	( W) 683 (W )	$A = 1.2 \text{ (M}_{P}) + 1.2 \times (1851) = 2221 \text{ kg}$		2,221
	M = M + 0.2 M		29	
	7	$(M_{\rm DV} < 4400)$		
9	224	$M_m = 0.0319  (M_{DV}) + 52 = 87  \text{kg}$		87
			62	
1	S C C	$M_{\rm H} = 0.0175 \; (M_{\rm DV}) + 52 = 71 \; \text{kg}$		71
	20	$P_{11} = 0.0438 \text{ (M}_{DV}) + 100 = 149 \text{ W}$	149	
	possessions and Docking	N/A	N/A	N/A
œ	Rendezvous and Docking	Sub Tot	5,560	4,845
	no tomorous	15% of the above power and mass	834	727
6	Contingency and integration		ь	$M_{ m PL}$
		. S 14 TOT	6 904	5 579

PLAT OTV:	PLATFORM MASS & POWER ESTIMATES OTV: Centaur, Expendable	C' - Non-serviced, OPER. MODE: replenished at 8 vrs	PLATFORM NO.	NO. 36rC' consumables
			Power	Mass
	Platform Elements	Estimating Basis	watts	kg
Τ.	Payload Equipment	Item: 16 Case: II ( $M_{ m py}$ < 3000)	4,970	1,225
2.	Structure - Basic	$M_g = 0.31  (M_{PY}) + 50 = 430  \text{kg}$	0	873
	- Secondary	$10\% \text{ of M}_{g} = 43 \text{ kg}$		
	- T/W Penalty	T/W = 1.76: Penalty = 400 kg		
3.	EPS	$M_{\rm F} = 0.0609 \; (P_{_{ m O}}) + 200 = 625 \; { m kg}$		625
		$P_{E} = 0.067 (P_{O}) + 100 = 568 W$	268	
4	ACS			210
		$P_A = 0.011 \text{ (M}_{PL}) + 30 = 85 \text{ W}$	82	
5.	RCS $M_p = 0.166  (M_{PL})$	$M_{R} = 1.2 (M_{p}) + 1.2 \times (823) = 987 \text{ kg}$		186
	$M_{R} = M_{P} + 0.2 M_{P}$	$P_{R} = 0.008 \text{ (M}_{PY}) + 20 = 30 \text{ W (M}_{PY} < 4400)$	30	
9.	TCC	$M_T = 0.0319  (M_{PY}) + 52 = 91  \text{kg}$		91
		11	64	
7.	TCS	11		73
			154	
8	Rendezvous and Docking	$M_{RD} = 0.0193 \; (M_{PY}) + 200 = 224 \; kg$		224
		$P_{RD} = 200 \text{ W}$	200	
		Sub Tot	6,069	4,309
יני	Contingency and Integration	15% of the above power and mass	910	646
			P o	MPL
NC	NC. OF PLATFORMS: 12	TOTALS:	6,980	4,956

PLATFORM MASS & POWER ESTIMATES OTV: OTV, Reusable
-
Item:
$M_{\rm S} = 0.31 \; (M_{\rm PY}) + 50 = 490 \; \rm kg$
10% of $M_S = 49 \text{ kg}$ T/W = 0.78; Penalty = 413 kg
M
٦ ٦
M
P A
$M_R = 1.2 \text{ (M}_{p^2} + 1.2 \times (921) = 1106 \text{ kg}$
$P_{R} = 0.008 \text{ (M}_{PY}) + 20 = 31 \text{ W (M}_{PY} < 4400)$
M
$P_T = 0.0195  (M_{PY}) + 40 = 68  W$
$M_H = 0.0175  (M_{PV}) + 52 = 77  \text{kg}$
- н Н
MRD
PRD
15% of the above power and mass

OTV:		over more replenished at 8 y		
	Platform Elements	Estimating Basis	Power,	Mass,
$\vec{-}$	Payload Equipment	Item: 18 Case: II (M <sub>PV</sub> < 3000)	5,925	1,367
2	Structure - Basic	$M_S = 0.31  (M_{PY}) + 50 = 474  \text{kg}$	0	521
	- Secondary	$108 \text{ of M}_{\rm s} = 47 \text{ kg}$		
	- T/W Penalty	T/W = 0.19; Penalty = 0 kg		
3	EPS	$M_{ m E} = 0.0609 \; (P_{ m o}) + 200 = 698 \; { m kg}$		869
		$P_{E} = 0.067 (P_{O}) + 100 = 648 W$	648	
4.	ACS	$M_A = 0.0294  (M_{PL}) + 64 = 204  \text{kg}$		204
		$P_A = 0.011  (M_{PL}) + 30 = 82  W$	82	
5.	RCS	$M_{R} = 1.2 (M_{D}) = 1.2 \times (790) = 948 \text{ kg}$		948
	$M_{R} = M_{P} + 0.2 M_{P}$	$P_{R} = 0.008 \text{ (M}_{PR}) + 20 = 31 \text{ W (M}_{PV} < 4400)$	31	
9.	TCC	$M_T = 0.0319  (M_{PY}) + 52 = 96  \text{kg}$		96
		$P_{T} = 0.0195  (M_{PY}) + 40 = 67  W$	29	
7.	TCS	$M_{H} = 0.0175  (M_{PY}) + 52 = 76  \text{kg}$		92
		$P_{H} = 0.0438  (M_{PV}) + 100 = 160  W$	160	
·	Rendezvous and Docking	$M_{RD} = 0.0193  (M_{PY}) + 200 = 226  kg$		226
		$P_{RD} = 200 \text{ W}$	200	
		Sub Tot	7,113	4,136
9.	Contingency and Integration	15% of the above power and mass	1,067	620
9	NO. OF PLATFORMS: 10	TOTALS	P 0 8 180	M <sub>PL</sub>

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	Platform Elements	Estimating Basis	Power, watts	Mass, kg
1	Payload Equipment	Item: 19 Case: II (M <sub>DV</sub> < 3000)	6,200	1,419
2.	Structure - Basic	$M_g = 0.31  (M_{PY}) + 50 = 490  \text{kg}$	0	539
	- Secondary	10% of M = 49 kg		
	- T/W Penalty	T/W = 0.07; Penalty = 0 kg		
3.	EPS	$M_E = 0.0713 (P_A) + 240 = 832 \text{ kg}$		832
		$P_{E} = 0.067 (P_{O}) + 100 = 657 W$	657	
4.	ACS	$M_A = 0.0294  (M_{DI}) + 64 = 266  \text{kg}$		266
		$P_A = 0.011 \text{ (M}_{DI}) + 30 = 105 \text{ W}$	105	
5.	RCS $M_{\rm p} = 0.332 \; (M_{\rm BT})$	$M_{D} = 1.2  (M_{D}) = 1.2 \times (2778) = 2733  \text{kg}$		2,733
	$M_{\mathbf{D}} = M_{\mathbf{D}} + 0.2 M_{\mathbf{D}}$	$P_{B} = 0.008  (M_{PY}) + 20 = 31  W$	31	
	J J J	(M <sub>PO</sub> < 4400)		
9	TCC	$M_{_{\rm DD}} = 0.0319 \text{ (M}_{_{\rm DD}}\text{)} + 52 = 97 \text{ kg}$		97
		$P_{T} = 0.0195 \text{ (M}_{DY}) + 40 = 68 \text{ W}$	89	
7.	TCS	$M_{LI} = 0.0175  (M_{DV}) + 52 = 77  \text{kg}$	,	77
		$P_{H} = 0.0438 \text{ (M}_{PY}) + 100 = 162 \text{ W}$	162	
8	Rendezvous and Docking	N/A	A/N	N/A
		Sub Tot	7,223	5,963
9.	Contingency and Integration	15% of the above power and mass	1,083	894
				"PL
	6	TOTALS:	8.306	9

IOTV, Expendable OTV:

C - Non-serviced, 16 year life OPER. MODE:

PLATFORM NO. 380C

	Platform Elements	Estimating Basis	Power,	, Mass,
1.	Payload Equipment	Item: 20 Case: III (M <sub>D.V</sub> < 3000)	6,000	
2.	Structure - Basic	$M_S = 0.31  (M_{PY}) + 50 = 534  \text{kg}$	0	
	- Secondary	$108 \text{ of M}_{S} = 53 \text{ kg}$		
	- T/W Penalty	T/W = 0.61; Penalty = 612 kg		
	EPS	$M_E = 0.0713 (P_o) + 240 = 817 \text{ kg}$		817
		$P_{E} = 0.067 (P_{O}) + 100 = 642 W$	642	
4.	ACS	$M_A = 0.0294  (M_{PL}) + 64 = 319  \text{kg}$		319
		$P_A = 0.011  (M_{PL}) + 30 = 125  W$	125	
5.	RCS $M_{\rm P} = 0.332  (M_{\rm PL})$	$M_{\rm R} = 1.2  (M_{\rm p}) + 1.2 \times (2876) = 3451  {\rm kg}$	50	3,451
	$M_{R} = M_{P} + 0.2 M_{P}$	$P_{R} = 9.008 \text{ (M}_{PV}) + 20 = 32 \text{ W}$	32	
.9	TCC	$M_{T} = 0.0319 \text{ (M}_{PY}) + 52 = 102 \text{ kg}$		102
		$P_{\rm T} = 0.0195 \; (M_{\rm PY}) + 40 = 70 \; \text{W}$	7.0	
7.	TCS	$M_{H} = 0.0175 \ (M_{PY}) + 52 = 79 \ kg$		7.9
		$P_{H} = 0.0438 \; (M_{PY}) + 100 = 168 \; W$	168	
<u>∞</u>	Rendezvous and Docking	N/A	N/A	N/A
		Sub Tot	7,039	7,527
6	Contingency and Integration	15% of the above power and mass	1,056	1,129
			Ь	M
NO.	NO. OF PLATFORMS: 9	TOT	TOTALS: 8,094	8 657

supply PLATFORM NO. 38rE

1. 2	A CONTRACTOR OF THE PARTY OF TH	The state of the s		
1.			Power,	Mass,
1.	Platform Elements	Estimating Rasis	Watte	a v
6	Payload Equipment	Item: 21 Case: II ( $M_{ m PY}$ < 2700)	000,9	1,361
1	Structure - Basic	$M_S = 0.35  (M_{PY}) + 50 = 526  \text{kg}$	0	6.26
	- Secondary	10% of M = 53 kg		
	- T/W Penalty	T/W = 1.76; Penalty = 400 kg		
3.	EPS	$M_{\rm E} = 0.0620 \; (P_{_{\rm O}}) + 210 = 723 \; {\rm kg}$		723
		$P_{\rm E} = 0.067 \ (P_{\rm o}) + 100 = 654 \ W$	654	
4.	ACS			178
		$P_A = 0.011 \text{ (M}_{PL}) + 30 = 82 \text{ W}$	82	
5.	RCS $M_D = 0.0623  (M_{PL})$	$M_{\rm R} = 1.2  (M_{\rm P}) = 1.2 \times (295) = 354  {\rm kg}$		354
	$M_{\mathbf{B}} = M_{\mathbf{P}} + 0.2 M_{\mathbf{P}}$	$P_{R} = 0.068 \text{ (M}_{PY}) + 20 = 31 \text{ W (M}_{PY} < 4400)$	31.	
6.	TCC			88
		11	29	
7.	TCS	$M_H = 0.0175  (M_{PY}) + 45 = 69  \text{kg}$		69
		11	600) 160	
%	Rendezvous and Docking	$M_{RD} = 0.1175  (M_{PY}) + 200 = 360  \text{kg}$		360
		$P_{RD} = 200 \text{ W}$	200	
		Sub Tot	7,193	4,112
9.	Contingency and Integration	15% of the above power and mass	1,079	617
			ь	$^{ m M_{PL}}$
Ç.	6 . SMACATA IG AC CH	TOTALS:		4,728

	Diotfour Dismonts	Ratimating Basis	Power,	Mass,
	Flatiorin Elements	record Amanual		9
1.	Payload Equipment	Item: 22 Case: II ( $M_{ m PY}$ < 3000)	6,000	1,561
2.	Structure - Basic	$M_S = 0.31  (M_{P,Y}) + 50 = 534  \text{kg}$	0	1,035
	- Secondary	$108 \text{ of M}_{S} = 53 \text{ kg}$		
	- T/W Penalty	T/W = 0.69; Penalty = 448 kg		
3.	EPS	$M_{\rm E} = 0.0609 \; (P_{\rm o}) + 200 = 706 \; {\rm kg}$		706
		$P_{\rm E} = 0.067 \; (P_{\rm O}) + 100 = 656 \; W$	656	
4.	ACS	11		237
		П	92	
5.	RCS $M_{\rm p} = 0.166  (M_{\rm PL})$	П		1,174
	$M_{\mathbf{R}} = M_{\mathbf{P}} + 0.2 M_{\mathbf{P}}$	$P_{R} = 0.0008 (M_{PY}) + 20 = 32 W (M_{PY} < 4400)$	32	
6.	TCC	11		102
		н	7.0	
7.	TCS	11		79
		$P_{H} = 0.0438  (M_{PY}) + 100 = 168  W$	168	
8	Rendezvous and Docking	$M_{RD} = 0.0193 \; (M_{PY}) + 200 = 230 \; kg$		230
		H	200	
		Sub Tot	7,222	5,124
6	Contingency and Integration	15% of the above power and mass	1,083	769
			ьо	$^{ m M}_{ m PL}$

OTV: Centaur, Expendable

OPER. MODE: B - Non-serviced, 8 year life, replaced

	Platform Elements	Estimating Basis	Power, watts	Mass, kg
1.	Payload Equipment	Item: 23 Case: II (M <sub>PY</sub> < 2200)	6,000	1,210
2.	Structure - Basic	$M_{_{S}} = 0.396 \ (M_{_{{PY}}}) + 50 = 529 \ kg$	0	982
	·- Secondary	$10\% \text{ of } M_S = 53 \text{ kg}$		
	- T/W Penalty	T/W = 1.76; Penalty = 400 kg		
3.	EPS	$M_E = 0.055 (P_O) + 187 = 627 kg$		627
		$P_{E} = 0.067 (P_{O}) + 100 = 637 W$	637	
4.	ACS	$M_A = 0.0228  (M_{PL}) + 50 = 156  \text{kg}$		156
		$P_A = 0.011 (M_{PL}) + 30 = 81 W$	81	
5.	$RCS M_{\mathbf{p}} = 0.166 (M_{\mathbf{p}_{\mathbf{L}}})$	$M_{R} = 1.2 (M_{P}) 1.2 \times (771) = 925 \text{ kg}$		925
	$M_{\mathbf{R}} = M_{\mathbf{P}} + 0.2 M_{\mathbf{P}}$	$P_{R} = 0.008  (M_{PY}) + 20 = 30W$	30	
		$(M_{PY} < 4400)$		
6.	TCC	$M_T = 0.0306  (M_{PY}) + 40 = 77  \text{kg}$		77
		$P_T = 0.0195 (M_{PY}) + 40 = 64 W$	64	
7.	TCS	$M_{H} = 0.0175 (M_{PY}) + 40 = 61 \text{ kg}$		61
		$P_{H} = 0.0438  (M_{PY}) + 100 = 153  W$	153	
8.	Rendezvous and Docking	N/A	N/A	N/A
		Sub Tot	6,964	4,039
9.	Contingency and Integration	15% of the above power and mass	1,045	606
			Po	$^{ m M}_{ m PL}$
NO	. OF PLATFORMS: 9	TOTA		4,645

Q-78

PLATFORM MASS & POWER ESTIMATES

	O	OTV: IOTV, L.T. Expendable	C' - Non-serviced, OPER. MODE: replenished at 8 yrs		NO. 39cC' consumables
		Platform Elements	Estimating Basis	Power,	Mass,
	~;	. Payload Equipment	Item: 24 Case: II (M < 3000)	0	9
	2.	Structure - Basic	M = 0.31 (M) + 60 - 670 M	0.550	1,703
		- Secondary	108 of M — FO 1	0	636
		T W Bonde	100 OLM = 38 Kg		
	c	0	T/W = 0.08; Penalty = 0 kg		
	÷.	EFS	$M_{E} = 0.0609 \; (P_{o}) + 200 = 822 \; kg$		822
	•		$P_{\rm E} = 0.067 \; (P_{\rm o}) + 100 = 784 \; W$	784	
G-	7*	ACS	A		231
29	u		$P_{A} = 0.011 \text{ (M}_{PL}) + 30 = 93 \text{ W}$	93	
		ACS M			1,134
	9	$^{\rm MR}$ = $^{\rm Mp}$ + 0.2 $^{\rm Mp}$	$P_{R} = 0.008  (M_{PY}) + 20 = 34  \text{W}  (M_{PY} < 4400)$	34	
	,				106
	4	3 C E		73	
	:				82
	œ	G C C C C C C C C C C C C C C C C C C C	$_{ m H}^{ m P} = 0.0438 \; (M_{ m PY}) + 100 = 175 \;  m W$	175	
	•	wendezvous and Docking	$M_{ m RD} = 0.0193 \; (M_{ m PY}) \; + \; 200 = 233 \; { m kg}$		233
			$\frac{P_{RD}}{RD} = 200 \text{ W}$	200	
	9.	Contingency and Internation	Sub Tot	8,879	4,947
		omingency and integration	15% of the above power and mass	1,332	742
-	70.	NO. OF PLATFORMS: 8	TOTALS:	P 0 10 210	$^{ m M_{PL}}$
				10,210	689,0

AT	LATFORM MASS & POWER ESTIMATES	OPER MODE: E-serviced, 16 yr life, 3 yr consumables supply	consumables supply
TV:	Centaur, I.T. Expendable	Power,	Mass,
		Estimating Basis watts	kg
	Platform Elements		1 496
	Pavload Equipment	0)	
5	Structure - Basic	$M_{\rm S} = 0.35  (M_{\rm PY}) + 50 = 574  {\rm kg}$	
	- Secondary	$108 \text{ of M}_{S} = 57 \text{ kg}$	
	- T/W Penalty	T/W = 0.19; Penalty = 0 kg	110
c	SQA	9,	
	EFS	$\frac{E}{P_{c}} = 0.067 \text{ (P_{c})} + 100 = 782 \text{ W}$ 782	
	000	kg	176
4.	ACO	$P_{\perp} = 0.011 \text{ (M}_{DI}) + 30 = 81 \text{ W}$	
1	(M) 8693 (M)	$M_{\odot} = 1.2  (M_{\rm D}) + 1.2  \times (289) = 347  \text{kg}$	347
2.	$KCS M_P = 0.0023 \text{ (mpL)}$ $M = M + 0.2 M_{\odot}$	$_{\rm P_{\rm B}}^{\rm R} = 0.008 \; (M_{\rm PV}) + 20 = 32 \; W \; (M_{\rm PY} < 4400)$ 32	
•	п. В п. В п. В п.	$M_{rr} = 0.0317  (M_{PV}) + 45 = 92  \text{kg}$	92
ο.		$= 0.0195  (M_{PY}^{1.1}) + 40 = 69  W$	69
t	3 C E	$M_{} = 0.0175  (M_{DV}) + 45 = 71  \text{kg}$	7.1
	ICS	$P_{\rm H} = 0.0438 \; (M_{\rm DV}) + 100 = 166 \; W \; (M_{\rm PY} < 2600) \; 166$	
0	neadown ond Docking	$M_{DN} = 0.1175  (M_{DV}) + 200 = 376  \text{kg}$	376
œ.		RD = 200  W	00
		RD Sub Tot 8,850	50 4,031
		1,327	
9.	Contingency and Integration	P O	$M_{ m b\Gamma}$
		TOTALS: 10,177	
ž	NO. OF PLATFORMS: 8		

OTV: OTV, Reusable

OPER. MODE: E-serviced, 16 yr life, 3 yr consumables supply

	Platform Elements	Estimating Basis	Power, watts	Mass, kg
1.	Payload Equipment	Item: 29 Case: III (M <sub>PY</sub> < 2700)	7,520	1,496
2.	Structure - Basic	$M_S = 0.35  (M_{PY}) + 50 = 574  \text{kg}$	0	1,044
	- Secondary	$10\% \text{ of } M_{S} = 57 \text{ kg}$		
	- T/W Penalty	T/W = 0.78; Penalty = 413 kg		
3.	EPS	$M_E = 0.0620 (P_O) + 210 = 841 \text{ kg}$		841
		$P_{E} = 0.067 (P_{O}) + 100 = 782 W$	782	
4.	ACS	$M_{\Lambda} = 0.0258 \ (M_{PL}) + 56 = 190 \ kg$		190
		$P_{\Delta} = 0.011 \ (M_{PL}) + 30 = 87 \ W$	87	
5.	RCS $M_{p} = 0.0623 \ (M_{PL})$	$M_{R} = 1.2 (M_{P}) + 1.2 \times (322) = 387 \text{ kg}$		387
	$M_{R} = M_{P} + 0.2 M_{P}$	$P_{R} = 0.008 (M_{PY}) + 20 = 32 W (M_{PY} < 4400)$	32	
6.	TCC	$M_{T} = 0.0317 (M_{PY}) + 45 = 92 \text{ kg}$		92
		$P_{T} = 0.0195 (M_{PY}) + 40 = 69 W$	69	
7.	TCS	$M_{H} = 0.0175  (M_{PV}) + 45 = 71  \text{kg}$		71
		$P_{H} = 0.0438  (M_{PY}) + 100 = 166  W  (M_{PY} < 2)$	600) 166	
8.	Rendezvous and Docking	$M_{RD} = 0.1175 (M_{PY}) + 200 = 376 \text{ kg}$		376
		$P_{RD}^{RD} = 200 \text{ W}$	200	
		Sub Tot	8,856	4,498
9.	Contingency and Integration	15% of the above power and mass	1,328	675
			Po	$^{\mathrm{M}}_{\mathrm{PL}}$
NO	. OF PLATFORMS: 8	TOTALS	-	5,173

PLATFORM MASS & POWER ESTIMATES

OTV: Centaur, L.T. Expendable

OPER. MODE: B - Non-serviced, 8 year life, replaced

	Platform Elements	Retimating Boois	Power,	Mass,
		roting Dasis	watts	kg
-	. Payload Equipment	Item: 27 Case: II (M <sub>D.V.</sub> < 2200)	7.620	1 360
2	Structure - Basic	$M_S = 0.396  (M_{DV}) + 50 = 600  \text{kg}$		22011
	- Secondary	10% of M = 60 kg	,	000
	- T/W Penalty	T/W = 0.19; Penalty = 0 kg		
с÷	EPS	$M_E = 0.055 (P_O) + 187 = 739 \text{ kg}$		739
		$P_{E} = 0.067 \; (P_{O}) + 100 = 773 \; W$	773	
4.	ACS	$^{M}_{A}$ = 0.0228 ( $^{M}_{PL}$ ) + 50 = 155 kg		155
L		$_{ m A}^{ m P} = 0.011 \; ({ m M}_{ m PL}) + 30 = 81 \; { m W}$	81	
	KCS M	$M_R = 1.2 (M_p) + 1.2 \times (766) = 919 \text{ kg}$		919
	$^{\mathrm{M}}\mathrm{R} = \mathrm{Mp} + 0.2 \mathrm{Mp}$	$^{ m P}_{ m R}$ = 0.008 ( $^{ m M}_{ m PY}$ ) + 20 = 31 W	31	
	CCE	$(M_{ m pY} < 4400)$		
		$M_{T} = 0.0306  (M_{PY}) + 40 = 83  \mathrm{kg}$		83
	i i	$P_{T} = 0.0195  (M_{PY}) + 40 = 67  \text{W}$	29	
	ICS	$^{M}_{H}$ = 0.0175 ( $^{M}_{PY}$ ) + 40 = 64 kg		64
α		$P_{H} = 0.0438 \text{ (M}_{PY}) + 100 = 161 \text{ W}$	161	
	nendezvous and Docking	N/A	N/A	N/A
6	Contingency and 1-4	Sub Tot	8,733	4,011
	commission and integration	15% of the abofe power and mass	1,310	602
0	NO. OF PLATFORMS: 7			$M_{\mathrm{PL}}$
		TOTALS: 10.042		4 619

1	Ö	OPER. MODE: B - Non-serviced, 8 year life, replaced	ced, 8 year lif	e, replaced
OTV:	OTV, Reusable		Power,	Mass,
		Estimati.g Basis	watts	kg
	Platform Elements	(000 > W) III	7,620	1,390
	Pavload Equipment	Item: 28 Case: III (Mpy 223)		,
	Structure - Basic	$M_s = 0.396  (M_{PY}) + 50 = 600  \text{kg}$	0	1,073
	- Secondary	$108 \text{ of M}_{\text{s}} = 60 \text{ kg}$		
	T/W Penalty	T/W = 0.78; Penalty = 413 kg		;
		$M = 0.055 (P_{\odot}) + 187 = 740 \text{ kg}$		740
÷	EPS	E = 0.067 (P) + 100 = 773 W	773	
		r-3		170
	ACS	MA - 0.0220 ("PL"	œ	
		$P_A = 0.011  (M_{PL}) + 30 = 88  W$		,
	( M) 911 0 - M 202	$M_{\rm p} = 1.2  (M_{\rm p}) + 1.2  \times (872) = 1046  \text{kg}$		1,046
	RCS Mp = 0.110 (".pL'	$R = 0.008 \text{ (M}_{2}) + 20 = 31 \text{ W}$	31	
	$M_R = M_P + 0.2 M_P$	R PY (M < 4400)		
		Ydw)		83
	201	$M_{T} = 0.0306  (M_{PY}) + 40 = 83  \text{kg}$		
0		$p = 0.0195  (M_{xx}) + 40 = 67  \text{W}$	29	
		$T = T$ $M = 0.0175 (M_{2}) + 40 = 64 \text{ kg}$		64
7	TCS	PY $PY$ $PY$ $PY$ $PY$ $PY$ $PY$ $PY$	161	
		Hpy	N/A	N/A
· ·	Rendezvous and Docking	N/A Sub Tot	8,740	4,566
		tee of the chove nower and mass	1,311	685
9.	Contingency and Integration	135 of the above power	Ъ	$M_{PL}$
		OF	TOTALS: 10,051	5,251

PLATFORM MASS & POWER ESTIMATES

	side at a year		replenished at 8 yrs
Platform Elements	Estimating Basis	Power,	Mass,
<ol> <li>Payload Equipment</li> </ol>	Item: 29 Case: II (M < 2000)		94
2. Structure - Basic	M = 0 00 M	7,620	1,793
Secondary	$_{\rm S}^{\rm M} = 0.31  ({ m M}_{ m PY}) + 50 = 606  { m kg}$ $10\%  { m of}  { m M} = 61  { m kg}$	0	1,158
	T/W = 064; Penalty = 492 kg		
3. EPS	$M_E = 0.0609 (P_o) + 200 = 831 \text{ kg}$		831
000	Н	794	
	$M_A = 0.6294  (M_{PL}) + 64 = 260  \text{kg}$		260
BOS M	11	103	001
M P	$M_{R} = 1.2 \text{ (M}_{p}) = 1.2 \times (1107) = 1329 \text{ kg}$		1,329
$\frac{m}{R} = \frac{m}{M} + 0.2 \frac{M}{P}$	$_{\rm R}^{\rm P} = 0.008  ({\rm M_{\rm PY}}) + 20 = 34  \text{W}  ({\rm M_{\rm PY}} < 4400)$	34	
	I		109
2 H Cs	$P_{T} = 0.0195  (M_{PY}) + 40 = 75  W$	75	
	$M_{H} = 0.0175  (M_{PY}) + 52 = 83  \text{kg}$		83
2 C	11	179	2
weildezvous and Docking	$^{ m M}_{ m RD}$ = 0.0193 ( $^{ m M}_{ m PY}$ ) + 200 = 235 kg		235
	${}^{P}_{RD} = 200 \text{ W}$	200	
9. Contingency and International	Sub Tot	9,005	5,797
	15% of the above power and mass	1,351	870
NO. OF PLATFORMS: 7	TOTALS:	P 0	$^{ m M}_{ m PL}$

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OTV: 4 STG, IUS (2L, 2L)	OPER. MODE: replenished at 8 yrs		
		Power,	Mass,
Platform Elements	Estimating Basis	watts	КĞ
. Payload Equipment	Item: 30 Case; III ( $M_{ m pY}$ < 3000)	7,620	1,793
2. Structure - Basic	$M_{\rm s} = 0.31  (M_{\rm PY}) + 50 = 606  \text{kg}$	ن	1,523
- Secondary	10%  of M = 61  kg		
- T/W Penalty	T/W = 1.93; Penalty = 857 kg		
3. EPS	$M_E = 0.0609 (P_O) + 200 = 831 \text{ kg}$		831
	$P_{E} = 0.067 (P_{Q}) + 100 = 794 W$	794	
4. ACS			277
		110	
5. $RCS M_{D} = 0.166 (M_{DI})$	$M_{\rm p} = 1.2  (M_{\rm p}) = 1.2 \times (1202) = 1442  \text{kg}$		1,442
$M_{\mathbf{D}} = M_{\mathbf{D}} = 0.1 M_{\mathbf{D}}$	$P_{\rm p} = 0.008  (M_{\rm py}) + 20 = 34  \text{W}  (M_{\rm py} < 4400)$	34	
6. TCC			109
	11	75	
7. TCS			83
	11	179	
8. Rendezvous and Docking			235
		200	
	Sub Tot	9,012	6,293
9. Contingency and Integration	15% of the above power and mass	1,352	944
	- O LY WOOD W	0	MPI
NO. OF FLATFORMS: 7	TOTALS	10,364	1,731

PLATFORM MASS & POWER ESTIMATES

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PLATFORM	16 year 1
ď	Non-serviced,
	- O
	OPER. MODE:

. 2		Estimating Basis	watts	kg
2	Payload Equipment	Item: 31 Case: III (M <sub>r.y.</sub> < 3000)	7.690	1 700
	Structure	$M_S = 0.31  (M_{PY}) + 50 = 606  \text{kg}$	0	666
	- Secondary	10% of M <sub>s</sub> = 61 kg		
	- T/W Penalty	T/W = 0.06; Penalty = 0 kg		
co.	EPS	$M_E = 0.0713 (P_O) + 240 = 962 \text{ kg}$		962
	2 2 2	$^{\mathrm{P}}_{\mathrm{E}}$ = 0.067 ( $^{\mathrm{P}}_{\mathrm{o}}$ ) + 100 = 779 W	779	
	ACS	$M_A = 0.0294  (M_{PL}) + 64 = 309  \text{kg}$		309
		$^{P}_{A} = 0.011 \; (M_{PL}) + 30 = 122 \; W$	122	
	$_{\rm RCS} \stackrel{\rm Mp}{=} = 0.332  ({\rm MpL})$	$M_R = 1.2  (M_p) + 1.2 \times (2766) = 3319  kg$		3,319
	$M_{\mathbf{R}} = M_{\mathbf{P}} + 0.2 M_{\mathbf{P}}$	$^{\mathrm{P}}_{\mathrm{R}} = 0.008 \; (\mathrm{M}_{\mathrm{PY}}) + 20 = 34 \; \mathrm{W}$	34	
9	504	$(M_{PY} < 4400)$		
		$M_{\rm T} = 0.0319 \; (M_{\rm PY}) + 52 = 109 \; {\rm kg}$		109
	508	$P_{T} = 0.0195  (M_{PY}) + 40 = 75  \text{W}$	75	
	103	11		83
00	Rendezvous and Desise	$^{P}_{H} = 0.0438  (M_{PY}) + 100 = 179  \text{W}$	179	
	secretary and Docking	N/A	N/A	N/A
6	Contingency and Issue	Sub Tot	8,808	7,241
	control and integration	15% of the above power and mass	1,321	1,086
	NO. OF PLATFORMS: 7	P 0 0		$^{ m M}_{ m PL}$

PLATFORM NO. 40mC

OTV:\_\_\_\_

OPER. MODE: C - Non-serviced, 16 year life

	Platform Elements	Estimating Basis	Power, watts	Mass, kg
1.	Payload Equipment	Item: 32 Case: III (M <sub>PY</sub> < 3000)	8,120	2,276
2.	Structure - Basic	$M_S = 0.31  (M_{PY}) + 50 = 754  kg$	0	1,545
	- Secondary	10% of M = $75  kg$		
	- T/W Penalty	T/W = 0.43; Penalty = 716 kg		
3.	EPS	$M_E = 0.0713 (P_O) + 240 = 1013 kg$		1,013
		$P_{E} = 0.067 (P_{O}) + 100 = 826 W$	826	
4.	ACS	$M_A = 0.0294  (M_{PL}) + 64 = 404  \text{kg}$		404
		$P_A = 0.011 \ (M_{PL}) + 30 = 157 \ W$	157	
5.	$RCS M_{p} = 0.332 (M_{PL})$	$M_{R} = 1.2 (M_{p}) = 1.2 \times (3841) = 4609 \text{ kg}$		4,609
	$M_{R} = M_{P} + 0.2 M_{P}$	$P_{R} = 0.008 \text{ (M}_{PY}) + 20 = 38 \text{ W (M}_{PY} < 4400)$	38	
6.	TCC	$M_{T}^{0.0319} (M_{PY}^{0}) + 52 = 124 \text{ kg}$		124
		$P_{T} = 0.0195 (M_{PY}) + 40 = 84 W$	84	
7.	TCS	$M_{H} = 0.0175 (M_{PY}) + 62 = 92 \text{ kg}$		92
		$P_{H} = 0.0438  (M_{PY}) + 100 = 199  W$	199	
8.	Rendezvous and Docking	N/A	N/A	N/A
		Sub Tot	9,425	10,057
9.	Contingency and Integration	15% of the above power and mass	1,414	1,509
			Po	$^{ m M}_{ m PL}$
NO.	OF PLATFORMS: 6	TOTALS:	10,839	11,566

O.T.V.	IOTV, L.T. Expendable	OPER, MODE: Supply		yr comsumantes
	1 '	Fower, Estimating Basis watts	ower,	Mass, kg
	Platform Element	33 Case: II (M < 2700)	8,120	1,980
	Payload Equipment			017
2.	Structure - Basic	$M_{\rm S} = 0.35  (M_{\rm PY}) + 50 = 743  \text{kg}$	0	0.1
	- Secondary	$10\% \text{ of M}_{S} = 74 \text{ kg}$		
	- T/W Penalty	T/W = 0.08; Penalty = 0 kg		
~	SCH	$M_{\odot} = 0.0620 \text{ (P_{\odot})} + 210 = 891 \text{ kg}$		891
		= 0.067 (P) + 100 = 836 W	836	
	0 0 0	E o $M = 0.0258  (M_{\odot}) + 56 = 203  \text{kg}$		203
		11	. 26	
Ľ	BCS M = 0.0623 (M.)	A PL $M_{\odot} = 1.2  (M_{\odot}) = 1.2 \times (354) = 425  \text{kg}$		425
	M = M + 0.2 M	$_{\rm P}$ = 0.008 ( $_{\rm M_{2.2}}$ ) + 20 = 36 W ( $_{\rm D_{2.2}}$ < 4400)	36	
9	TCC	$M_{rr} = 0.0317 \text{ (M}_{DV}) + 45 = 108 \text{ kg}$		108
	)))	H	67	
7	SOF	H		80
		$= 0.0438 \text{ (M}_{PA}) + 100 = 187 \text{ M (M}_{PV} < 2600)$	187	
α	Rendezvous and Docking	$M_{2.5} = 0.1175  (M_{D.V}) + 200 = 433  \text{kg}$		433
:		= 200 W	200	
		Sub Tot	9,549	4,935
		15% of the above power and mass	1,432	740
n.	Contingency and integration	1		$^{ m M}_{ m PL}$
		10 089 10 18 10 089	000	5 676

	PLATFORM MASS & POWER ESTIMATES OTV: OTV, L.T. Expendable	C' - Non-serviced, OPER. MODE: replenished at 8 yr	PLATFORM NO. 16 yr life, cons	O. 40dC'
	Platform Elements	Estimating Basis	Power, watts	Mass, kg
	1. Payload Equipment	Item: 34 Case: II (M <sub>PV</sub> < 3000)	8,120	2,103
	2. Structure - Basic	$M_S = 0.31  (M_{PV}) + 50 = 702  \text{kg}$	0	772
	- Secondary	$108 \text{ of M}_{\rm S} = 70 \text{ kg}$		
	- T/W Penalty	T/W = 0.07; Penalty = 0 kg		
	3. EPS	$M_{E} = 0.0609 \; (P_{o}) + 200 = 870 \; kg$		870
		$P_{E} = 0.067 (P_{o}) + 100 = 837 W$	837	
	4. ACS	$M_A = 0.0294 \text{ (M}_{PL}) + 64 = 259 \text{ kg}$		259
		$P_A = 0.011 \text{ (M}_{PL}) + 30 = 103 \text{ W}$	103	
	5. RCS $M_p = 0.166  (M_{PL})$			1,324
	$M_{\mathbf{R}} = M_{\mathbf{P}} + 0.2 M_{\mathbf{P}}$	$P_{R} = 0.008 \text{ (M}_{PY}) + 20 = 37 \text{ W (M}_{PV} < 4400)$	37	
	6. TCC	$M_{\rm T} = 0.0319 \; (M_{\rm PY}) + 52 = 119 \; {\rm kg}$		119
		11	81	
	7. TCS	$M_{H} = 0.0175  (M_{PY}) + 52 = 89  \text{kg}$		68
		$P_{H} = 0.0438  (M_{PY}) + 100 = 192  W$	192	
	8. Rendezvous and Docking			241
		$P_{RD} = 200 \text{ W}$	200	
		Sub Tot	9,571	5,778
	9. Contingency and Integration	15% of the above power and mass	1,436	867
2	NO. OF PLATFORMS: 6	TOTALS:	P o 11.006	M <sub>PL</sub>
-			200111	0,00

LAIFORM MASS & FOWER ESTIMATES

supply
consumables
3 yr
life,
yr
16
E-serviced,
MODE:
OPER.

PLATFORM NO. 40fE

OT'V:	/: IOIV, Expelidable	OPER, MODE:		
			Power,	Mass,
	Platform Elements	Estimating Basis	wutts	kg
-:	Payload Equipment	Item: 35 Case: II (Mpv < 2700)	8,120	1,980
2.	Structure - Basic	$M_{\rm c} = 0.35  (M_{\rm p,V}) + 50 = 743  \text{kg}$	0	1,265
	- Secondary	$108 \text{ of M}_{S} = 74 \text{ kg}$		
	- T/W Penalty	T/W = 0.69; Penalty = 448 kg		
3.	EPS	$M_E = 0.0620 (P_O) + 210 = 891 \text{ kg}$		891
		$P_{E} = 0.067 (P_{O}) + 100 = 836 W$	836	
4.	ACS	$M_A = 0.0258  (M_{PL}) + 56 = 218  \text{kg}$		218
		$P_A = 0.011  (M_{PL}) + 30 = 99  W$	66	
5.	RCS $M_{\rm p} = 0.0623  (M_{\rm pr})$	$M_D = 1.2  (M_D) = 1.2 \times (390) = 468  \text{kg}$		468
	$M_{\rm p} = M_{\rm p} + 0.2 M_{\rm p}$	$P_{D} = 0.008 \text{ (M}_{DV}) + 20 = 36 \text{ W (M}_{PY} < 4400)$	36	
9	TCC	$M_T = 0.0317  (M_{PY}) + 45 = 108  \text{kg}$		108
		$P_T = 0.1095  (M_{PX}) + 40 = 79  W$	4.6	
7.	TCS	$M_{H} = 0.0175  (M_{PY}) + 45 = 80  \text{kg}$	*	80
		$P_{H} = 0.0438 \text{ (M}_{PY}) + 100 = 187 \text{ W (M}_{PY} < 2600)$	187	
8	Rendezvous and Docking	$M_{RD} = 0.1175  (M_{PX}) + 200 = 433  \text{kg}$		433
		$P_{BD} = 200 \text{ W}$	200	
		Sub Tot	9,556	5,442
9.	Contingency and Integration	15% of the above power and mass	1,433	816
		TOTALS	000	M <sub>PL</sub>
N	NO. OF PLATFORMS: 6		10,990	20710

	-	1	
	2	THE TOTAL	
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PLATFORM NO. 40cB	OPER. MODE: B - Non-serviced, 8 year life, replaced	Domon Mass
PLATFORM MASS & POWER ESTIMATES	OTV: IOTV, L.T. Expendable	

			Power,	Mass,
	Platform Elements	Estimating Basis	watts	kg
-:	Payload Equipment	Item: 36 Case: II (Mpy < 2200)	8,120	1,630
2.	Structure - Basic	$M_{\rm S} = 0.396 \; (M_{\rm PY}) + 50 = 695 \; \rm kg$	0	765
	- Secondary			
	- T/W Penalty	T/W = 0.08; Penalty = 0 kg		
3.	EPS	$M_{\rm F} = 0.055 \; (P_{_{ m O}}) + 187 = 775 \; { m kg}$		775
		$P_{E} = 0.067 (P_{O}) + 100 = 817 W$	817	
4	ACS	$M_A = 0.0228  (M_{PL}) + 50 = 169  \text{kg}$		169
		$P_A = 0.011 \text{ (M}_{PL}) + 30 = 87 \text{ W}$	28	
5.	RCS $M_{\rm D} = 0.166  (M_{\rm DL})$	$M_{\rm R} = 1.2 \; (M_{\rm P}) = 1.2 \times (866) = 1040 \; {\rm kg}$	B	1,740
	$M_{\mathbf{R}} = M_{\mathbf{P}} + 0.2 M_{\mathbf{P}}$	$P_{R} = 0.008  (M_{PY}) + 20 = 33  W$	33	
		The state of the s		00
6.	TCC	$ m M_{T} = 0.0306~(M_{PY}) + 40 = 90~kg$		90
		$P_{T} = 0.0195 \text{ (M}_{PY}) + 40 = 72 \text{ W}$	7.2	
7.	TCS	$M_{H} = 0.0175  (M_{PY}) + 40 = 69  \text{kg}$		69
		$P_H = 0.0438 \; (M_{PY}) + 100 = 171 \; W$	171	
· ·	Rendezvous and Docking	Y/N	A/A	N/A
			9,300	4,537
9.	Contingency and Integration	15% of the above power and mass	1,395	681
			ď	$^{ m M_{PL}}$
S	NO OF PLATFORMS. 6		TOTALS: 10,695	5,218

LAT	LATFORM MASS & POWER ESTIMATES	OPER. MODE: B - Non-serviced,	PLATFORM NO. 1915 8 year life, replaced	eplaced
1			Power,	Mass.
	Platform Elements	Estimating Basis	watts	kg
1.	Payload Equipment	Item: 37 Case: II (Mpv < 2200)	8,120	1,630
2.	Structure - Basic		0	1,213
	- Secondary	$108 \text{ of M}_{S} = 70 \text{ kg}$		
	- T/W Penalty	T/W = 0.69; Penalty = 488 kg		
3.	EPS	$M_E = 0.055 (P_A) + 187 = 776 \text{ kg}$		176
		= 0.067	817	
4.	ACS	= 0.022		185
			92	,
5.	RCS $M_{\mathbf{D}} = 0.166  (M_{\mathbf{DI}})$	$M_{\rm B} = 1.2  (M_{\rm p}) = 1.2  \times (981) = 1178  \text{kg}$		1,178
	$M_{\rm B} = M_{\rm p} + 6.2 M_{\rm p}$		33	
.9	Toc	$M_T = 0.0306  (M_{PY}) + 40 = 90  \text{kg}$		06
		$P_T = 0.0195  (M_{PY}) + 40 = 72  W$	7.2	
7.	TCS	11		69
		11	171	
8	Rendezvous and Docking	_	N/A	N/A
		Sub Tot	9,308	5,139
9.	Contingency and Integration	15% of the above power and mass	1,396	771
		O TA STOR	P 0 10 704	M PL 5 910
NO.	NO. OF PLATFORMS: 6	TOTALD	10,104	0,010

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 41hC

OPER. MODE: C - Non-serviced, 16 year life

LALICIUM MADD & FOWER EDIIMATES	endable
FOWER	Ext
S CCVIV	OTV, L.T. Exp
TOTTOTT	OTV: OT

			Power.	Mass.
	Platform Elements	Estimating Basis	watts	
1.	Payload Equipment	Item: 38 Case: III (M <sub>D.V</sub> < 3000)	8,630	2.541
2.	Structure - Basic	$M_{_{\mathbf{Q}}} = 0.31  (M_{_{\mathbf{D}}\mathbf{V}}) + 50 = 838  \text{kg}$	0	921
	- Secondary	$108 \text{ of M}_{\odot} = 84 \text{ kg}$		
	- T/W Penalty	T/W = 0.05; Penalty = 0 kg		
3	EPS	$M_E = 0.0713 (P_o) + 240 = 1059 kg$		1,059
		$P_{E} = 0.067 (P_{O}) + 100 = 870 W$	870	
4.	ACS	$M_A = 0.0294  (M_{PL}) + 64 = 385  \text{kg}$		382
		$P_A = 0.011 \text{ (M}_{PL}) + 30 = 150 \text{ W}$	150	
2.	RCS $M_p = 0.332  (M_{PL})$	$M_{\rm B} = 1.2 \; (M_{\rm D}) = 1.2 \times (3620) = 4345 \; {\rm kg}$	4,345	
	$M_{R} = M_{P} + 0.2 M_{P}$	$P_{R} = 0.008 \text{ (M}_{PY}) + 20 = 40 \text{ W}$		
		$(M_{PY} < 4400)$		
9	TCC	$M_T = 0.0319 \ (M_{PV}) + 52 = 133 \ kg$		133
		$P_T = 0.0195 \ (M_{PV}) + 40 = 90 \ W$	06	
7.	TCS	$M_H = 0.0175  (M_{PY}) + 52 = 96  \text{kg}$		96
		$P_{H} = 0.0438 \text{ (M}_{PY}) + 100 = 211 \text{ W}$	211	
· ·	Rendezvous and Docking	N/A	N/A	N/A
		Sub Tot	9, 991	9,480
9.	Contingency and Integration	15% of the above power and mass	1,499	1,422
9			Ро	$^{ m M_{PL}}$
NO	NO. OF PLATFORMS: 5	TOT	TOTALS: 11,489	10,902

OTV: OTV, Expendable

OPER. MODE: E-serviced, 16 yr life, 3 yr consumables supply

	Platform Elements	Estimating Basis	Power, watts	Mass, kg
1.	Payload Equipment	Item: 39 Case: II (Mpy < 2700)	8,630	2,216
2.	Structure - Basic	$M_{g} = 0.35  (M_{PY}) + 50 = 826  kg$	0	1,400
	- Secondary	10% of M <sub>g</sub> = 83 kg		
	- T/W Penalty	T/W = 0.64; Penalty = 492 kg		
3.	EPS	$M_E = 0.0620 (P_O) + 210 = 917 kg$	•	917
		$P_{E} = 0.067 (P_{O}) + 100 = 864 W$	864	
4.	ACS	$M_A = 0.0258 \ (M_{PL}) + 56 = 232 \ kg$		232
		$P_A = 0.011 \ (M_{PL}) + 36 = 105 \ W$	105	
5.	RCS $M_{p} = 0.0623  (M_{pl})$	$M_{R} = 1.2 (M_{P}) + 1.2 \times (426) = 511 \text{ kg}$		511
	$M_{\mathbf{R}} = M_{\mathbf{P}} + 0.2 M_{\mathbf{P}}$	$P_{R} = 0.008 \text{ (M}_{PV}) + 20 = 38 \text{ W (M}_{PV} < 4400 \text{ M}_{PV}$	38	
6.	TCC	$M_{T} = 0.0317 (M_{PV}) + 45 = 115 \text{ kg}$		115
		$P_{T} = 0.0195 \ (M_{PY}) + 40 = 83 \ W$	83	
7.	TCS	$M_{H} = 0.0175 (M_{PY}) + 45 = 84 \text{ kg}$		84
		$P_{H} = 0.0438  (M_{PY}) + 100 = 197  W  (M_{PY} < 2)$	(600) 197	
8.	Rendezvous and Docking	$M_{RD} = 0.1175 (M_{PY}) + 200 = 460 \text{ kg}$		460
		$P_{RD} = 200 \text{ W}$	200	
		Sub Tot	9.917	5,935
9.	Contingency and Integration	15% of the above power and mass	1,488	890
			Po	$^{ m M}_{ m PL}$
NO.	OF PLATFORMS: 5	TOTALS		6,825

PLATFORM MASS & POWER ESTIMATES

OTV: OTV, Expendable

	OI	OTV: OTV, Expendable	OPER. MODE: B - Non-serviced, 8 year life, replaced	year life,	replaced
		Platform Elements	Estimating Basis	Power,	Mass, kg
	1.		Item: 40 Case: II (M <sub>DV</sub> < 2200)	8.630	1 970
	5	Structure	$M_S = 0.396  (M_{PV}) + 50 = 830  \text{kg}$	0	1,405
		- Secondary	$108 \text{ of M}_{\odot} = 83 \text{ kg}$	×	2014
			T/W = 0.64; Penalty = 492 kg		
	<del>ن</del>	EPS	$M_{E} = 0.055 (P_{o}) + 187 = 813 kg$		813
	,		$P_{E} = 0.067 (P_{o}) + 100 = 863 W$	863	
G-	4.	ACS	$M_A = 0.0228 \ (M_{PL}) + 50 = 205 \ kg$		205
.45	L		$P_A = 0.011  (M_{PL}) + 30 = 105  \text{W}$	105	
		$^{\rm RCS} M_{\rm p} = 0.166 (M_{\rm PL})$	$^{ m M}_{ m R}$ = 1.2 ( $^{ m M}_{ m P}$ ) = 1.2 × (1132) = 1358 kg		1,358
	,	$M_{\rm R} = M_{\rm P} + 0.2 M_{\rm P}$	$P_{R} = 0.008 \text{ (M}_{PY}) + 20 = 36 \text{ W (M}_{PY} < 4400)$	36	
		) )	$M_T = 9.0306  (M_{PY}) + 40 = 100  \text{kg}$		100
	1	e e	$P_{T} = 0.0195  (M_{PY}) + 40 = 78  W$	78	
		TCS	$M_{H} = 0.0175  (M_{PY}) + 40 = 74  \text{kg}$		74
	٥	Q. Pass Q.	$P_{H} = 0.0438  (M_{PY}) + 100 = 186  W$	186	
		Rendezvous and Docking	N/A	N/A	N/A
	6	Contingential	Sub Tot	868,6	5,927
		commission and integration	15% of the above power and mass	1,485	888

6,816

11,382 o م

TOTALS:

2

NO. OF PLATFORMS:

 $^{
m M_{PL}}$ 

PLATFORM NO. 41eB

PLATFORM MASS & POWER ESTIMATES

OTV: IOTV, Expendable

OPER. MODE: \_replenished at 8 yrs

Ì	Platform Elements	Estimating Basis	Power,	Mass,
1	. Payload Equipment	Item: 41 Case: III (M < 3000)	069 0	
2	2. Structure - Basic	M = 0.31 (M ) 150 000	8,630	2,541
		$_{\rm S}$ = 0.31 ( $_{\rm M}$ $_{\rm PY}$ ) + 30 = 838 kg	0	1,533
	- Secondary	$10\% \text{ of M}_{S} = 84 \text{ kg}$		
	- T/W Penalty	T/W = 0.51; Penalty = 612 kg		
3.	. EPS	$M_{\rm E} = 0.0609 \; (P_{\rm o}) + 200 = 913 \; {\rm kg}$		913
,		$P_{E} = 0.067 (P_{o}) + 100 = 884 W$	884	
G-	. ACS	$M_A = 0.0294 \ (M_{PL}) + 64 = 318 \ kg$		318
		$P_{A} = 0.011  (M_{PL}) + 30 = 125  \text{C}$	125	
5.	RCS M	$M_R = 1.2 \text{ (M}_p) = 1.2 \times (1433) = 1720 \text{ kg}$		1.720
	$M_{\rm R} = M_{\rm P} + 0.2  M_{\rm P}$	$P_{\rm R} = 0.008 \; (M_{\rm DV}) + 20 = 40 \; W \; (M_{\rm Ny}) < 4400)$	40	
.9	TCC	$M_{Tr} = 0.0319  (M_{Tr}) + 52 = 133  kg$	}	,
		PY		133
t		$P_{\rm T} = 0.0195  (M_{\rm PY}) + 40 = 90  \text{W}$	90	
	TCS	$M_{H} = 0.0175  (M_{PY}) + 52 = 96  \text{kg}$		96
		$P_{H} = 0.0438 \ (M_{PY}) + 100 = 211 \ W$	211	
×.	Rendezvous and Docking	$M_{RD} = 0.0193  (M_{PY}) + 200 = 249  kg$		249
		${\rm P_{RD}=200W}$	200	
c		Sub Tot	10,180	7,503
9.	Contingency and Integration	15% of the above power and mass	1,525	1,126
CN	NO OF DIATEODMS.		P <sub>o</sub>	M <sub>PL</sub>
		TOTALS	11 707	069 0

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	OPER.
×	
PLATFORM MASS & POWER ESTIMATES	
POWER	-11-
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MASS	
PLATFORM	

pendable	Domon Mess,	-	
	The state of the s	Power,	Mess,
	Estimating Basis	watts	Kg
	10040	8,630	2,216
	Item: 42 Case II (Mpy < 2100)	•	806
Pillerin	$M = 0.35  (M_{DA}) + 50 = 826  \text{kg}$	>	}
Structure - Basic s	00 1:0		
- Secondary 10% of M	10% of M = 83 kg		
$_{-}$ T/W Penalty $_{-}$ T/W = 0.	T/W = 0.07; Penalty = 0 Kg		932
	$M_{\odot} = 0.0620 \text{ (P}_{\odot}) + 210 = 932 \text{ kg}$		
EPS = 0.0	$= 0.067 (P_{\odot}) + 100 = 880 W$	880	916
$\Xi$ . $M = 0.0$	$= 0.0258  (M_{\rm ex}) + 56 = 216  \text{kg}$		77
~	= 0.011  (M) + 30 = 98  W	86	
	-0.011  mpL -0.011  mpL -0.011  mpL -0.011  mpL		464
RCS $M_{\rm p} = 0.0623  (M_{\rm pL})$ $M_{\rm R} = 1.2$	(MP) 1:2 (MP) < 4400)	38	
$= M_{\rm p} + 0.2 M_{\rm p}$ PR	0.008 (MPY) + 40 = 30 m (mpy		115
A	$M = 0.0317 (M_{XX}) + 45 = 115 \text{ kg}$		-
$TCC \qquad \qquad T \qquad \qquad P_{m} = 0.$	$_{\rm T}^{\rm T}$ $_{\rm P, T}^{\rm P, T}$ $_{\rm P, T}^{\rm P, T}$ $_{\rm P, T}^{\rm T}$ $_{\rm P, T}$ $_$	83	84
$\frac{1}{N} = 0.$	$M = 0.0175  (M_{DV}) + 45 = 84  \text{kg}$		
TCS $H = 0$ .	$= 0.0438 \text{ (M}_{\text{DV}}) + 100 = 197 \text{ W (M}_{\text{PY}} < 2600)$	00) 197	094
E W	$= 0.1176  (M_{PY}) + 200 = 460  \text{kg}$		
	= 200 W	200	
RD	Sub Tot	10, 127	5,390
	15% of the above power and mass	$_{ m o}^{ m 1,519}$	$^{809}_{PL}$
9. Centingency and integration	TOTALS:	11,646	6,205

PLATFORM NO. 41VE

ylddr

1. Payload Equipment Item: 43 Case: III ( $M_{PY}$ < 2700)  2. Structure - Basic $M_S = 0.35 \ (M_{PY}) + 50 = 826 \ kg$ - Secondary $M_S = 83 \ kg$ - T/W Penalty $M_S = 0.0620 \ (P_O) + 210 = 933 \ kg$ 4. ACS $M_P = 0.0623 \ (M_{PL})$ $M_R = 0.0258 \ (M_{PL}) + 30 = 111 \ W$ 5. RCS $M_P = 0.0623 \ (M_{PL})$ $M_R = 1.2 \ (M_P) = 1.2 \times (456) = 548 \ kg$ May a $M_R = 1.2 \ (M_P) = 1.2 \times (456) = 548 \ kg$ For a $M_R = 0.008 \ (M_{PY}) + 45 = 115 \ kg$ For a $M_R = 0.0175 \ (M_{PY}) + 40 = 83 \ W$ The a $M_R = 0.0175 \ (M_{PY}) + 40 = 83 \ W$ For a $M_R = 0.0175 \ (M_{PY}) + 100 = 197 \ W \ M_R = 0.0175 \ (M_{PY}) + 200 = 460 \ kg$ For a $M_R = 0.009$ Redezvous and Docking $M_R = 0.0175 \ (M_{PY}) + 200 = 460 \ kg$ For a $M_R = 0.009$				
Payload Equipment Item: Structure - Basic $\frac{A}{C}$ - Secondary $\frac{A}{C}$ - T/W Penalty $\frac{A}{C}$ = $\frac{A}{C}$ - T/W Penalty $\frac{A}{C}$ = $\frac{A}{C}$ - T/W Penalty $\frac{A}{C}$ = $\frac{A}{C}$ -	Estimating Basis		Power, watts	Mass, kg
Structure - Basic $\frac{N}{C} = \frac{10\% \text{ o}}{C}$ $\frac{10\% \text{ o}}{C} = $	III (M <sub>pv</sub> < 2	700)	8,630	2,216
EPS - Secondary 10% of the condary 10% of the cond	+50 = 826  kg		0	1,765
EPS $ \begin{array}{c} - T/W \; \text{Penalty} \\ - T/W \; \text{Penalty} \\ \text{ACS} \\ \text{ACS} \\ \text{ACS} \\ \text{ACS} \\ \text{MR} = 0.0623 \; (\text{M}_{\text{PL}}) \\ \text{MR} = \frac{\text{P}_{\text{R}}}{\text{P}_{\text{R}}} = \frac{\text{P}_{\text{R}}}{\text{P}_{R$				
EPS  ACS  ACS  ACS  ACS  RCS $M_P = 0.0623 (M_{PL})$ $M_R = M_P + 0.2 M_P$ TCC  TCC  Rendezvous and Docking $M_{RD} = 0.0623 (M_{PL})$ $M_R = 0.063 (M_{PL})$ $M_R = 0.063$	ty = 857  kg			
ACS $M_{P} = 0.0623 \ (M_{PL})$ $M_{R} = 0.0623 \ (M_{R})$	+ 210 = 933  kg			933
ACS $M_{P} = 0.0623  (M_{PL})$ $M_{R} = \frac{P_{A}}{R} = $	100 = 881  W		881	
RCS $M_P = 0.0623 (M_{PL})$ $M_R = M_R = 0.0623 (M_{PL})$ $M_R = 0.0633 (M_{P$	+56 = 245  k	ь		245
RCS $M_P = 0.0623 (M_{PL})$ $M_R = M_R + 0.2 M_P$ $P_R = TCC$ $M_T = TCS$ $M_H = P_H = P_$	+ 30 = 111  W		111	
$M_{R} = M_{P} + 0.2 M_{P} \qquad P_{R} = 0.2 M_{P} \qquad M_{T} = 0.2 M_{P} \qquad M_{H} = 0.2 M_{H} = $	$1.2 \times (456) = 9$	148 kg		548
TCC $M_T = \frac{P_T}{P_T} = P_T$	+20 = 38  W	$M_{PV} < 4400$	38	
TCS $M_{H} = M_{H} = M$	+ 45 = 115  k			115
TCS MH = PH = PH = RD RD RD PRD PRD PRD PRD PRD PRD PRD PR	+ 40 = 83  W		83	
Rendezvous and Docking MRD RD PRD	+45 = 8%  kg			84
Rendezvous and Docking MRD RD PRD	V + 100 = 197 V	$^{\prime}$ (M $_{ m PY}$ < 2600	197	
$P_{RD} = 200 \text{ W}$	$_{T}$ ) + 200 = 460	kg		460
			200	
	Su	Sub Tot	10,140	8,366
9. Contingency and Integration 15% of the above power and mass	ower and mass		1,521	955
NO. OF PLATFORMS: 5		TOTALS:	P o 11.661	MPL 7.321

IL	ORM	PLATFORM MASS	-45	ĭ	POWER	ESTIM
OTV	4	STG,	ΙŪ	IUS (	(2L, 2L)	(T)
				1		

TV	4 STG, IUS (2L, 2L)	OPER. MODE: B - Non-serv	- Non-serviced, 8 year life, replaced	fe, replaced
	Platform Elements	Estimating Basis	Power, watts	Mass, kg
Ξ.	Payload Equipment	Item: 44 Case: III ( $M_{\mathbf{DV}} < 2200$ )	8,630	1,970
2.	Structure - Basic	$M_S = 0.396  (M_{PY}) + 50 = 830  \text{kg}$	0	1,770
	Secondary	$108 \text{ of M}_{g} = 83 \text{ kg}$		
	- T/W Penalty	T/W = 1.93; Penalty = 857 kg		
3.	EPS	$M_{E} = 0.055 (P_{o}) + 187 = 813 \text{ kg}$		813
		$P_{E} = 0.067 (P_{O}) + 100 = 863 W$	863	
4.	ACS	11		218
			1111	
5.	RCS $M_p = 0.166  (M_{PL})$	$M_R = 1.2 (M_P) = 1.2 \times (1225) = 1471 \text{ kg}$		1,471
	$M_{R} = M_{P} + 0.2 M_{P}$	$P_{R} = 0.008  (M_{PY}) + 20 = 36  \text{W}$	36	
.9	TCC	$M_{T} = 0.0306  (M_{PY}) + 40 = 100  \text{kg}$		100
		$P_{T} = 0.0195  (M_{PY}) + 400 = 78  W$	78	
7.	TCS	$M_H = 0.0175  (M_{PY}) + 40 = 74  \text{kg}$		7.4
		$P_{\rm H} = 0.5438 \; (M_{\rm PY}) + 100 = 186 \; W$	186	
8	Rendezvous and Docking	N/A	N/A	N/A
		Sub Tot	9,904	6,417
6	Contingency and Integration	15% of the above power and mass	1,486	963
			о	$^{ m M_{PL}}$
0.	O. OF PLATFORMS: 5	TOTALS:	.S: 11,390	7,380

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LATFORM MASS & POWER ESTIMATES		PLATFORM NO. 41dB	41dB
rv: OTV, L.T. Expendable	OPER, MODE;B - Non-serviced, 8 year life, replaced	year life, repl	aced
Platform Elements	Estimating Basis	Power, watts	Mass, kg
Payload Equipment	Item: 45 Case: II (M <sub>DV</sub> < 2200)	8,630	2.970
Structure - Basic	$M_S = 0.396 \ (M_{PY}) + 50 = 830 \ kg$	0	913
- Secondary	$10\% \text{ of M}_{s} = 83 \text{ kg}$		
- T/W Penalty	T/W = 0.07; Penalty = 0 kg		
EPS	$M_{E} = 0.055 (P_{o}) + 187 = 812 \text{ kg}$		812
	$F_{\rm E} = 0.067 \; (P_{\rm o}) + 100 = 862 \; \text{W}$	862	
ACS	$M_A = 0.0228 \text{ (M}_{PL}) + 50 = 188 \text{ kg}$		188
	$P_A = 0.011  (M_{PL}) + 30 = 97  W$	97	
RCS $M_P = 0.166  (M_{PL})$	$M_{R} = 1.2  (M_{P}) = 1.2  \times (1006) = 1207  \text{kg}$		1,207
$M_{R} = M_{P} + 0.2 M_{P}$	$P_{R} = 0.008 \text{ (M}_{PY}) + 20 = 36 \text{ W (M}_{PY} < 4400)$	36	
TCC	$M_{\rm T} = 0.0366 \; (M_{\rm PY}) + 40 = 100 \; {\rm kg}$		100
	$P_T = 0.0195 \text{ (M}_{PY}) + 40 = 78 \text{ W}$	78	
TCS	$M_H = 0.0175  (M_{PX}) + 40 = 74  \text{kg}$		74
	$_{ m H}^{ m P} = 0.0438 \; ({ m M}_{ m PY}) + 100 = 186 \; { m W}$	186	
Kindezvous and Docking	N/A	N/A	N/A
	Sub Tot	9,889	5,265
Contingency and Integration	15% of the above power and mass	1,483	790

 $^{\rm M}_{\rm PL}$ 

P 0 TOTALS: 11,372

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NO. OF PLATFORMS:

9.

CTAIL	PLATFORM MASS & CHERNOLOGY. IOTV. IOTV. L.T. Expendable	OPER. MODE: replenished at 8 yrs	yr life,	consumant
	1 1		Power,	Mass,
	Platform Elements	Estimating Basis	watts	kg
-	Davidsed Equipment	Item: 46 Case: III (M <sub>DV</sub> < 3000)	8,630	2,541
	Structure - Basic	$M = 0.31  (M_{\rm D}) + 50 = 838  \text{kg}$	0	921
	- Secondary	$\begin{array}{cccccccccccccccccccccccccccccccccccc$		
	- T/W Penalty	T/W = 0.06; Penalty = 0 kg		
~	Sagr	$M_{\rm p} = 0.0609 \; (P_{\rm p}) + 200 = 912 \; kg$		912
•		$P_{E} = 0.067 (P_{O}) + 100 = 884 W$	884	
V	S C	$M_{\star} = 0.0294 \text{ (M}_{DI}) + 64 = 290 \text{ kg}$		290
		$P_{\star} = 0.011 \text{ (M}_{DI}) + 30 = 114 \text{ W}$	114	
Ľ	$RCS M = 0.166 (M_{-1})$	$M_{\rm p} = 1.2  (M_{\rm p}) = 1.2  \times (1274) = 1529  \text{kg}$		1,529
	$M_{\rm p} = M_{\rm p} + 0.2 M_{\rm p}$	$P_{R} = 0.008 \text{ (M}_{PY}) + 20 = 40 \text{ W (M}_{PY} < 4400)$	40	
c	1 1 X	$M_{\odot} = 0.0319 \text{ (M}_{\odot}) + 52 = 133 \text{ kg}$		133
. 0		$P_{\text{max}} = 0.0195 \text{ (M}_{\text{pay}}) + 40 = 90 \text{ W}$	06	
t	S C E			
:		$P_{11} = 0.0438 \text{ (M}_{PO}) + 100 = 211 \text{ W}$	211	
α	Rendezvous and Docking	$M_{PR} = 0.0193 \text{ (M}_{PQ}) + 200 = 249 \text{ kg}$		
		$P_{\text{max}} = 200 \text{ W}$	200	
		RD Sub Tot	10,169	6,672
9.	Contingency and Integration	15% of the above power and mass	$_{ m p}^{1,525}$	$\stackrel{1,001}{M_{\mathrm{PL}}}$
		TOTALS:	11,694	7,673

PLATFORM MASS & POWER ESTIMATES

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OPER. MODE: replenished at 8 yrs

	Platform Elements	Estimating Basis	Power, watts	Mass,
	2. Structure - Basic	Item: 47 Case: III ( $M_{PY} \ge 3000$ )	11,000	3,418
	Secondary	$_{ m S}$ = 0.223 (M $_{ m PY}$ ) + 300 = 1069 kg 10% of M = 107 kg	0	1,892
	3. EPS	T/W = 0.43; Penalty = 716 kg $M_E = 0.0609 (P_D) + 200 = 1100 kg$		
4	I. ACS		1,090	1,100
5	5. RCS M = 0.166 (M )	$^{''}A = 0.0234  (^{M}P_{L}) + 64 = 386  \text{kg}$ $^{P}A = 0.011  (^{M}P_{L}) + 30 = 150  \text{W}$	150	386
9	M TCC	$^{ m M}_{ m R}$ = 1.2 ( $^{ m M}_{ m p}$ ) = 1.2 × (1817) = 2181 kg $^{ m P}_{ m R}$ = 0.008 ( $^{ m M}_{ m PY}$ ) + 20 = 47 W ( $^{ m M}_{ m PY}$ < 4400)	47	2,181
)		$M_{\rm T} = 0.0319 \; (M_{\rm PY}) + 52 = 161 \; \text{kg}$ $P_{\rm L} = 0.0195 \; (M_{\rm PY}) + 52 = 161 \; \text{kg}$		161
7.	TCS	$M_{\rm H} = 0.0175  (M_{\rm PY}) + 52 = 112  \text{kg}$	107	110
· ·	Rendezvous and Docking	$^{ m P}_{ m H}$ = 0.0438 ( $^{ m M}_{ m PY}$ ) + 160 = 250 W $^{ m M}_{ m RD}$ = 0.0193 ( $^{ m M}_{ m PY}$ ) + 200 = 266 kg	250	396
		$^{\mathrm{P}}_{\mathrm{RD}}$ = 200 W	200	0
9.	Contingency and Integration	Sub Tot 15% of the above power and mass	12,844	9,515
ON	NO. OF PLATFORMS: 4	POTATO	1, 927 P	1,427 MPL
		COLALS:	14,771	10,942

OTV: IOTV, Expendable

PLATFORM NO. 430E OPER. MODE: E-serviced, 16 yr life, 3 yr consumables supply

	Platform Elements	Estimating Basis	Power, watts	Mass, kg
	Payload Equipment	Item: 48 Case: III (M <sub>S</sub> > 2700)	11 000	0
5	Structure - Basic	$M_{\odot} = 0.259  (M_{\odot}) + 300 = 1072  \text{kg}$		106,2
	- Secondary	$_{\rm S}$ $_{\rm I}$ $_{\rm F}$	>	1,791
	- T/W Penalty	T/W = 0.51; Penalty = 612 kg		
3.	EPS	$M_{E} = 0.0620 \text{ (P}_{O}) + 210 = 1122 \text{ kg}$		1,122
		$P_{E} = 0.067 (P_{o}) + 100 = 1085 W$	1,085	
	ACS	$M_{A} = 0.0258  (M_{PL}) + 56 = 281  \text{kg}$		281
		$^{P}A = 0.011 \text{ (M}_{PL}) + 30 = 126 \text{ W}$	126	
5.	RCS $M_p = 0.0623 (M_{PL})$	$M_R = 1.2 (M_p) + 1.2 \times (544) = 652 \text{ kg}$		652
0	$^{\rm MR}$ = $^{\rm MP}$ + 0.2 $^{\rm Mp}$	$^{P}_{R}$ = 0.008 ( $^{M}_{PY}$ ) + 20 = 44 W ( $^{M}_{PY}$ < 4400)	44	
	201	$M_{\rm T} = 0.0317 \; (M_{\rm PY}) + 45 = 139 \; {\rm kg}$		139
		$P_{T} = 0.0195  (M_{PY}) + 40 = 98  W$	86	
	TCS	$M_{H} = 0.0175  (M_{PY}) + 45 = 97  \text{kg}$		97
	3	$P_{H} = 0.0438 \text{ (M}_{PY}) + 100 = 231 \text{ W (M}_{DV} \ge 2600)$	231	
· ∞	Rendezvous and Docking	$^{M}_{RD}$ = 0.0388 ( $^{M}_{PY}$ ) + 400 = 516 kg		516
		${}^{P}_{RD} = 200 \text{ W}$	200	
		b Tot	12,784	7,580
	Contingency and Integration	15% of the above power and mass	1,918	1,137
	NO. OF PLATFORMS: 4	d O	ь О	$M_{PL}$

PL	PLATFORM MASS & POWER ESTIMATES		PLATFORM NO. 430B	O. 430B
OT	OTV: IOTV, Expendable	OPER. MODE: B - Non-serviced, 8 year life, replaced	year life, r	eplaced
	Platform Elements	Estimating Basis	Power,	Mass, kg
1.	Payload Equipment	Item: 49 Case: III ( $M_{\rm py} \ge 2200$ )	11,000	2,650
2.	Structure - Basic	$M_{\rm S} = 0.29 \; (M_{ m PY}) + 300 = 1069 \;  m kg$	0	1,787
	- Secondary	$10\% \text{ of M}_{S} = 107 \text{ kg}$		
	- T/W Penalty	T/W = 0.51; Penalty = 612 kg		
3.	EPS	$M_{E} = 0.055 (P_{o}) + 187 = 980 \text{ kg}$		086
		$\frac{P}{E} = 0.067  (\frac{P}{O}) + 100 = 1066  W$	1,066	
4.	ACS	$M_A = 0.0228 \text{ (M}_{PL}) + 50 = 250 \text{ kg}$		250
		$P_A = 0.011  (M_{PL}) + 30 = 126  W$	126	
5.	RCS $M_p = 0.166  (M_{PL})$	$M_B = 1.2 (M_p) = 1.2 \times (1455) = 1746 \text{ kg}$		1,746
	$M_{R} = M_{P} + 0.2 M_{P}$	$P_{R} = 0.008  (M_{PY}) + 20 = 41  \text{W}  (M_{PY} < 4400)$	41	
9	TCC	$M_T = 0.0306  (M_{PY}) + 40 = 121  \text{kg}$		121
		$P_{T} = 0.0195  (M_{PY}) + 40 = 92  W$	92	
7.	TCS	$M_{H} = 0.0175  (M_{PY}) + 40 = 86  \text{kg}$		98
		$P_{H} = 0.0438 \ (M_{PY}) + 100 = 216 \ W$	216	
8	Rendezvous and Docking	N/A	N/A	N/A
		Sub Tot	12,542	7,621
9.	Contingency and Integration	15% of the above power and mass	1,881	1,143
			d.	M
NO	NO. OF PLATFORMS: 4	TOTALS:	14,423	8,764
	Control of the contro			

OT	OTV: 2 STG. OTV, Reusable	OPER. MODE: C - Non-serviced, 16 year life	16 year life	
	Platform Elements	Estimating Basis	Power,	Mass, kg
Τ.	Payload Equipment	Item: 50 Case: III ( $M_{PY} \ge 3000$ )	11,000	3,418
2.	Structure - Basic	$M_S = 0.225  (M_{PY}) + 300 = 1069  kg$	0	1,956
	- Secondary	10%  of M = 107  kg		
	- T/W Penalty	T/W = 0.31; Penalty = 780 kg		
3.	EPS	$M_{E} = 0.0713 (P_{o}) + 240 = 1280 \text{ kg}$		1,280
		${ m P_E} = 0.067 \; ({ m P_O}) \; + \; 100 \; = \; 1077 \; { m W}$	1,077	
4.	ACS	$M_A = 0.0294  (M_{PL}) + 64 = 529  \text{kg}$		529
G-5		$P_A = 0.011  (M_{PL}) + 30 = 204  W$	204	
5.	$RCS M_p = 0.332 (M_{PL})$	$M_{ m R} = 1.2  (M_{ m p}) = 1.2   imes (5256) = 6307  { m kg}$		6,307
	$M_{\rm R} = M_{\rm P} = 0.2  M_{\rm P}$	$P_{R} = 0.008 \text{ (M}_{PY}) + 20 = 47 \text{ W (M}_{PY} < 4400)$	47	
9	TCC	$M_T = 0.0319  (M_{PY}) + 52 = 161  \text{kg}$		161
		$P_{T} = 0.0195 \; (M_{PY}) + 40 = 107 \; W$	107	
7.	TCS	$M_{H} = 0.0175  (M_{PY}) + 52 = 112  \text{kg}$		112
		$P_{H} = 0.0438  (M_{PY}) + 100 = 250  W$	250	
· ·	Rendezvous and Docking	N/A	N/A	N/A
		Sub Tot	12,686	13,764
9.	Contingency and Integration	15% of the above power and mass	1,903	2,065
			d.o	MPL
N	NO OF BLATEOBMS:	TOTALS	14.588	15.829

	PL	PLATFORM MASS & POWER ESTIMATES		ATFORM NO	43hC'
	OTV:	V; OTV, L.T. Expendable	C' - Non-serviced, 16 yr life, consumables OPER, MODE: replenished at 8 yrs	6 yr life, c	onsumables
		77 14		Power,	Mass,
		Flatiorm Elements	Estimating Basis	watts	kg
	Ξ.	Payload Equipment	item: 51 Case: III ( $M_{DV} \ge 3000$ )	11,000	3,418
	2.	Structure - Basic	$M_{_{\rm S}} = 0.225 \; (M_{_{\rm D}}) + 300 = 1069 \; \text{kg}$	0	1.176
		- Secondary	$108 \text{ of M}_{c} = 107 \text{ kg}$	!	
		- T/W Penalty	T/W = 0.05; Penalty = 0 kg		
	3.	EPS	$M_{ m E} = 0.0609 \; (P_{ m o}) \; + \; 200 \; = \; 1083 \; { m kg}$		1,083
			$P_{E} = 0.067 (P_{o}) + 100 = 1072 W$	1,072	
C	4.	ACS	$M_A = 0.0294 \ (M_{PL}) + 64 = 352 \ kg$		352
3-56			$P_A = 0.011  (M_{PL}) + 30 = 138  W$	138	
5	5.	RCS $M_{\rm p} = 0.166  (M_{\rm pL})$	$M_{\rm R} = 1.2  (M_{\rm D}) = 1.2  \times (1627) = 1952   {\rm kg}$		1,952
		$M_{\mathbf{R}} = M_{\mathbf{P}} + 0.2 M_{\mathbf{P}}$	$P_{\rm B} = 0.008  (M_{\rm DV}) + 20 = 47  \text{W}  (M_{\rm DV} > 4400)$	47	
	9.	TCC			161
			11	107	
	7.	TCS	$M_{H} = 0.0175  (M_{PY}) + 52 = 112  kg$		112
			$P_{H} = 0.0438 \text{ (M}_{PY}) + 100 = 250 \text{ W}$	250	
	· •	Rendezvous and Docking	$M_{RD} = 0.9193  (M_{PV}) + 200 = 266  \text{kg}$		260
			${}^{\rm P}_{\rm RD} = 200 \text{ W}$	200	
			Sub Tot	12,614	8,521
	0	Contingency and Integration	15% of the above power and mass	1,892	1,278
	NO.	NO. OF PLATFORMS: 4	TOTATS	P 0	MPL
			COLAMB	14,506	9,799

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	OPER. MODE: E
FLATFORM MASS & POWER ESTIMATES	OTV: IOTV, L.T. Expendable

PLATFORM NO. 43gE

			Power,	Mass.
	Platform Elements	Estimating Basis	watts	kg
	Payload Equipment	Item: 52 Case: III ( $M_{p_Y} \ge 2700$ )	11,000	2,981
2.	Structure - Basic	$M_S = 0.259  (M_{PY}) + 300 = 1072  kg$	0	1,179
	- Secondary	$10\% \text{ of M}_{S} = 107 \text{ kg}$		
	- T/W Penalty	T/W = 0.06; Penalty = 0 kg		
33	EPS	$M_E = 0.0620 (P_o) + 210 = 1121 \text{ kg}$		1,121
		$P_{\rm E} = 0.067 \; (P_{\rm o}) + 100 = 1084 \; W$	1,084	
4.	ACS	$M_A = 0.0258 (M_{PL}) + 56 = 260 \text{ kg}$		260
		$P_A = 0.011  (M_{PL}) + 30 = 117  W$	1117	
5.	RCS $M_{\rm p} = 0.0623  (M_{\rm pL})$	$M_{R} = 1.2 \text{ (M}_{p}) = 1.2 \times (493) = 592 \text{ kg}$		592
	$M_{R} = M_{P} + 0.2 M_{P}$	$P_{R} = 0.008 \text{ (M}_{PY}) + 20 = 44 \text{ W (M}_{PV} < 4400)$	44	
9.	TCC	$M_{T} = 0.0317  (M_{PY}) + 45 = 139  \text{kg}$		139
		$P_{T} = 0.0195 \text{ (M}_{PV}) + 40 = 98 \text{ W}$	86	
7.	TCS	$M_H = 0.0175  (M_{PY}) + 45 = 97  \text{kg}$		97
		$P_{H} = 0.0438 \text{ (M}_{PY}) + 100 = 231 \text{ W (M}_{PY} \ge 2600)$	0) 231	
· ·	Rendezvous and Docking	$^{\Gamma'}_{RD} = 0.0388 \; (M_{PY}) + 400 = 516 \; \text{kg}$		516
		$P_{RD} = 200 \text{ W}$	200	
		Sub Tot	12,774	6,886
9.	Contingency and Integration	15% of the above power and mass	1,916	1,033
(			Ь	M <sub>PL</sub>
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PLATFORM MASS & POWER ESTIMATES

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	Non-serviced.
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	MODE:
	OPER.

G-28	Payload Equipment		Z	-
-	rayman Edmpment			X PB
-		Item: 53 Case: III (M <sub>DV</sub> > 2200)	11,000	2.650
	Structure	$M_{_{\rm S}} = 0.29  (M_{_{\rm DV}}) + 300 = 1069  \text{kg}$		1 175
	- Secon ary	10%  of M = 107  kg	,	1,113
	- T/W Penalty	T/W = 0.06; Penalty = 0 kg		
	EPS	$M_{\rm F} = 0.055 \; (P_{\odot}) + 187 = 980 \; \text{kg}$		o
		$P_{E} = 0.067 (P_{O}) + 100 = 1065 W$	1.065	980
	ACS	$M_A = 0.0228  (M_{PL}) + 50 = 228  \text{kg}$		228
5.		$P_A = 0.011 \ (M_{PL}) + 30 = 116 \ W$	116	
	RCS $M_{\rm p} = 0.166  (M_{\rm pL})$	$M_{R} = 1.2  (M_{D}) = 1.2 \times (1298) = 1558  \text{kg}$		1 558
	$M_{R} = M_{P} + 0.2 M_{P}$	$P_{R} = 0.008  (M_{PY}) + 20 = 41  \text{W}  (M_{PY} < 4400)$	41	
р.	TCC	$M_T = 0.0306  (M_{PY}) + 40 = 121  \text{kg}$		121
		$P_{T} = 0.0195 \; (M_{PY}) + 40 = 92 \; W$		
	TCS	$M_{H} = 0.0175  (M_{PY}) + 40 = 86  \text{kg}$		98
		$P_{\rm H} = 0.0438 \; (M_{\rm PY}) + 100 = 216 \; {\rm W}$	216	
×.	Rendezvous and Docking	N/A	N/A	N/A
0		Sub Tot	12,530	6,798
	Contingency and Integration	15% of the above power and mass	1,880	1,020
ON	ON OF BY A TRACE OF		Ь	M <sub>D</sub> r
	OF FLAIFORMS: 4	TOTALS:	14.410	7 817

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PLATFORM NO. 43jC	OPER, MODE: C - Non-serviced, 16 year life	
PLATFORM MASS & POWER ESTIMATES	OTV: 2 STG. OTV, L.T. Reusable	

			Power,	Mass,
	Platform Elements	Estimating Basis	watts	kg
ij	Payload Equipment	Item: 54 Case: III ( $M_{\rm pY} \ge 3000$ )	11,000	3,418
2.	Structure - Basic	$M_{\rm S} = 0.225 \; (M_{\rm PY}) + 300 = 1069 \; {\rm kg}$	0	1,176
	- Secondary	108  of M = 107  kg		
	- T/W Penalty	T/W = 0.03; Penalty = 0 kg		
3.	EPS	$M_{\rm E} = 0.0713 \; (P_{\rm O}) + 240 = 1278 \; {\rm kg}$		1,278
		$P_{E} = 0.067 (P_{O}) + 100 = 1076 W$	1,076	
4.	ACS	$M_A = 0.0294  (M_{PL}) + 64 = 477  \text{kg}$		477
		$P_A = 0.011  (M_{PL}) + 30 = 185  W$	185	
5.	RCS $M_{\rm p} = 0.332  (M_{\rm PL})$	$M_{\rm R} = 1.2  (M_{\rm p}) + 1.2 \times (4669) = 5603  {\rm kg}$		5,603
	$M_{\mathbf{B}} = M_{\mathbf{P}} + 0.2 M_{\mathbf{P}}$	$P_{B} = 0.008 \text{ (M}_{PY}) + 26 = 47 \text{ W (M}_{PY} < 4400)$	47	
9	TCC	$M_T = 0.0319 \text{ (M}_{PY}) + 52 = 161 \text{ kg}$		161
		$P_{T} = 0.0195  (M_{PY}) + 40 = 107  W$	107	
7.	TCS	$M_{H} = 0.0175 \text{ (M}_{PY}) + 52 = 112 \text{ kg}$		112
		$P_{H} = 0.0438 \text{ (M}_{PY}) + 100 = 250 \text{ W}$	250	
œ	Rendezvous and Docking	N/A	N/A	N/A
		Sub Tot	12,664	12,226
9.	Contingency and Integration	15% of the above power and mass	1,900	1,834
			s	2
		STATOL	0 14 564	MPL 14 059
NO	NO. OF PLATFORMS: 4		14,304	660,61

	Platform Elements	Estimating Basis	Power, watts	Mass, kg
1.	Payload Equipment	Item: 55 Case: III $(M_{PY} \ge 2200)$	15,500	3,480
2.	Structure - Basic	$M_S = 0.29 (M_{PY}) + 300 = 1309 kg$	0	2,156
	- Secondary	$10\% \text{ of M}_{S} = 131 \text{ kg}$		
	- T/W Penalty	T/W = 0.43; Penalty = 716 kg		
3.	EPS	$M_{E} = 0.055 (P_{O}) + 187 = 1295 kg$		1,295
		$P_{E} = 0.067 (P_{O}) + 100 = 1449 W$	1,449	
4.	ACS	$M_A = 0.0228  (M_{PL}) + 50 = 305  \text{kg}$		305
		$P_A = 0.011 \ (M_{PL}) + 30 = 153 \ W$	153	
5.	$RCS M_{p} = 0.166 (M_{PL})$	$M_R = 1.2 (M_p) + 1.2 \times (1854) = 2224 \text{ kg}$		2,224
	$M_{R} = M_{P} + 0.2 M_{P}$	$P_{R} = 0.008 \text{ (M}_{PY}) + 20 = 48 \text{ W (M}_{PY} < 4400)$	48	
6.	TCC	$M_{T} = 0.0306  (M_{PY}) + 40 = 146  kg$		146
		$P_{T} = 0.0195 \ (M_{PY}) + 40 = 108 \ W$	108	
7.	TCS	$M_{H} = 0.0175 (M_{PY}) + 40 = 101 \text{ kg}$		101
		$P_{H} = 0.0438 \ (M_{PY}) + 100 = 252 \ W$	252	
8.	Rendezvous and Docking	N/A	N/A	N/A
		Sub Tot	17,510	9,707
9.	Contingency and Integration	15% of the above power and mass	2,626	1,456
NO	. OF PLATFORMS: 3	TOTALS:	20,136	11,163

OTV: OTV, Expendable

OPER. MODE: E-serviced, 16 yr life, 3 yr consumables supply

PLATFORM NO. 44hE

	Platform Elements	Estimating Basis	watts	mass, kg
	1. Payload Equipment	Item: 56 Case: III ( $M_{\rm py} \ge 2700$ )	15,500	3,915
-	2. Structure - Basic	$M_S = 0.259 \ (M_{PY}) + 300 = 1314 \ kg$	0	2,161
	- Secondary	10%  of M = 131  kg		
	- T/W Penalty	T/W = 0.43; Penalty = 716 kg		
	3. EPS	$M_{ m E} = 0.0620 \; { m (P}_{ m O}) \; + \; 210 = 1476 \; { m kg}$		1,476
		$P_{E} = 0.067 (P_{o}) + 100 = 1468 W$	1,468	
	4. ACS	$M_A = 0.0258  (M_{PL}) + 56 = 339  \text{kg}$		339
		$P_A = 0.011  (M_{PL}) + 30 = 151  W$	151	
	5. RCS $M_{\rm p} = 0.0623  (M_{\rm pL})$			821
	$M_{\rm R} = M_{\rm P} + 0.2 M_{\rm P}$	$P_{\rm R} = 0.008 \; (M_{\rm DY}) + 20 = 51 \; \text{W} \; (M_{\rm DV} < 4400)$	51	
_	6. TCC	$M_{\rm T} = 0.0317 \; (M_{\rm PX}) + 45 = 169 \; {\rm kg}$		169
			116	
	7. TCS	$M_H = 0.0175  (M_{PY}) + 45 = 114  \text{kg}$		114
		$P_{H} = 0.0438  (M_{PY}) + 100 = 271  \text{W}  (M_{PY} \ge 2600)$	00) 271	
3	8. Rendezvous and Docking	$M_{RD} = 0.0388 \; (M_{PY}) + 400 = 552 \; kg$		552
		$P_{RD} = 200 \text{ W}$	200	
		Sub Tot	17,758	9,547
0,	9. Contingency and Integration	15% of the above power and mass	2,664	1,432
Z	NO. OF PLATFORMS: 3	TOTALS:	P o 20.422	$M_{ m PL}$

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PLATFORM NO. 44hB

	OTV:	V: OTV, L.T. Expendable	OPER. MODE: B - Non-serviced, 8 year life, replaced	year life, r	eplaced
		Platform Elements	Estimating Basis	Power, watts	Mass, kg
	1.	Payload Equipment	Item: 57 Case: III ( $M_{\rm py} \ge 2200$ )	15,500	3,480
	2.	Structure - Basic	$M_{\rm S} = 0.29 \; (M_{ m PX}) + 300 = 1309 \; { m kg}$	0	1,440
		- Secondary	10%  of M = 131  kg		
		- T/W Penalty	T/W = 0.05; Penalty = 0 kg		
	3.	EPS	$M_{E} = 0.055 (P_{o}) + 187 = 1294 \text{ kg}$		1,294
			$P_{\rm E} = 0.067 \; (P_{\rm O}) + 100 = 1448 \; W$	1,448	
C	4.	ACS	$M_A = 0.0228  (M_{PL}) + 50 = 279  \text{kg}$		279
3-62			$P_A = 0.011  (M_{PL}) + 30 = 141  W$	141	
	2.	RCS $M_p = 0.166  (M_{PL})$	$M_{\rm R} = 1.2  (M_{\rm p}) = 1.2  \times (1670) = 2004   {\rm kg}$		2,004
		$M_{\mathbf{R}} = M_{\mathbf{P}} + 0.2 M_{\mathbf{P}}$	$P_{R} = 0.008  (M_{PY}) + 20 = 48  \text{W}  (M_{PY} < 4400)$	48	
	.9	TCC	$M_{T} = 0.0306  (M_{PY}) + 40 = 146  kg$		146
				108	
	7.	TCS	$M_{H} = 0.0175  (M_{PY}) + 40 = 101  \text{kg}$		101
			$P_{H} = 0.0438 \; (M_{PY}) + 100 = 252 \; W$	252	
	8	Rendezvous and Docking	N/A	N/A	N/A
			Sub Tot	17,497	8,744
	9.	Contingericy and Integration	15% of the above power and mass	2,625	1,312
				Q.	M
	ON	NO OF PLATFORMS: 3	TOTALS:	o 20,121	$_{10,056}$

OTV: OTV, L.T. Expendable

OPER. MODE: E-serviced, 16 yr life, 3 yr consumables supply

PLATFORM NO. 44hE

	Platform Elements	Estimating Basis	watts	kg
1.	Payload Equipment	Item: 58 Case: III (M > 2700)	15, 500	2 01,
2.	Structure - Basic	$M_{\rm S} = 0.259 \; (M_{\rm D, V}) + 300 = 1314 \; \rm kg$		1 445
	- Secondary	$108 \text{ of M}_{c} = 131 \text{ kg}$	,	
	- T/W Penalty	T/W = 0.05; Penalty = 0 kg		
3.	EPS	$M_E = 0.0620 (P_O) + 210 = 1475 kg$		1,475
		${ m P}_{ m E} = 0.067 \ { m (P}_{ m O}) + 100 = 1467 \  m W$	1,467	
	ACS	$M_A = 0.0258 \ (M_{PL}) + 56 = 315 \ kg$		315
		$P_A = 0.011  (M_{PL}) + 30 = 141  W$	141	
5.	RCS $M_{\rm p} = 0.0623  (M_{\rm pL})$	$M_{ m R}$ = 1.2 ( $M_{ m p}$ ) = 1.2 × (626) = 751 kg		751
	$M_{R} = M_{P} + 0.2 M_{P}$	$P_{R} = 0.008  (M_{PY}) + 20 = 51  \text{W}  (M_{PY} < 4400)$	51	
. 9	TCC	$M_{\rm T} = 0.0317 \ (M_{\rm PY}) + 45 = 169 \ {\rm kg}$		169
		$P_{T} = 0.0195  (M_{PY}) + 40 = 116  W$	116	
7.	TCS	$M_H = 0.0175  (M_{PY}) + 45 = 114  \text{kg}$		114
		$P_{H} = 0.0438 \text{ (M}_{PY}) + 100 = 271 \text{ W (M}_{DV} \ge 2600)$	271	
œ	Rendezvous and Docking	$M_{RD} = 0.0388  (M_{PY}) + 400 = 552  \text{kg}$		552
		$P_{RD} = 200 \text{ W}$	200	
		Sub Tot	17,747	8,737
9.	Contingency and Integration	15% of the above power and mass	2,662	1,311
	NO OF PLATFORMS.		ь	$^{ m M_{PL}}$

Estimatii  Estimatii  Item: 59 Case: III ( $^{\rm P}$ $^{\rm R}$ $^{\rm S}$ = 0.225 ( $^{\rm M}$ $^{\rm P}$ + 300 $^{\rm S}$ $^{\rm 10\$}$ of $^{\rm M}$ = 172 kg $^{\rm T}/W$ = 0.035; Penalty = $^{\rm R}$ $^{\rm T}/W$ = 0.0609 ( $^{\rm P}$ ) + 100 $^{\rm P}$ $^{\rm E}$ = 0.067 ( $^{\rm P}$ ) + 100 $^{\rm P}$ $^{\rm R}$ = 0.067 ( $^{\rm P}$ ) + 100 $^{\rm P}$ $^{\rm R}$ = 0.0594 ( $^{\rm M}$ $^{\rm P}$ $^{\rm P}$ $^{\rm A}$ = 0.0294 ( $^{\rm M}$ $^{\rm P}$ $^{\rm P}$ $^{\rm R}$ = 0.011 ( $^{\rm M}$ $^{\rm P}$ $^{\rm P}$ $^{\rm R}$ = 0.013 ( $^{\rm M}$ $^{\rm P}$ ) + 20 $^{\rm R}$ $^{\rm R}$ $^{\rm R}$ = 0.0145 ( $^{\rm M}$ $^{\rm P}$ $^{\rm R}$	replenished at 8 yrs  Power, Mass,	watts Kg		0 1,894		1 807		1,808		216	3, 301	190) 71		163	103	377	322	200	22,944 14,671
	C' - Non-serviced, 1 OPER. MODE: replenished at 8 yrs	Estimating Basis	Item: 59 Case: III (Mpy > 3000)	$M_S = 0.225  (M_{PY}) + 300 = 1722  \text{kg}$	$10\% \text{ of M}_{S} = 172 \text{ kg}$	T/W = 0.035; Penalty = 0 kg	$M_{\rm E} = 0.0609 \; (P_{\rm O}) + 200 = 1807 \; {\rm kg}$	$P_{E} = 0.067 (P_{o}) + 100 = 1868 W$	$M_{\star} = 0.0294  (M_{\rm PI}) + 64 = 560  \text{kg}$	$P_{\rm A} = 0.011 \; (M_{\rm DL}) + 30 = 216 \; W$	$_{\rm M_{\odot}}^{\rm A}$ = 1.2 (M <sub>D</sub> ) = 1.2 × (2801) = 3361 kg	$\frac{R}{P_D} = 0.008 \text{ (M}_{PY}) + 20 = 71 \text{ W (M}_{PY} \ge 44$	$M_{\rm D} = 0.0263  (M_{\rm DV}) + 77 = 243  \text{kg}$	$T$ $T$ $P_{m} = 0.0195  (M_{PV}) + 40 = 163  W$	$M = 0.0175  (M_{DQ}) + 52 = 163  \text{kg}$	$_{\rm P}$ = 0.0438 (M <sub>2.7</sub> ) + 100 = 377 W	$^{\rm H}$	MRD STORY PY	$P_{RD} = 200 \text{ W}$
	3 SRM				- Secondary	- T/W Penalty	FDS			ACS		RCS	1					<ol> <li>Rendezvous and Docking</li> </ol>	

2,201 MpL 16,872

3,442 P 0 26,386

TOTALS:

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15% of the above power and mass

9. Contingency and Integration

2

NO. OF PLATFORMS:

OTV: 2 STG. OTV, Reusable

C' - Non-serviced, Te yr life, consumables Over MODE: replenished at 8 yrs

10	010	OYEN, MODE:		
			Power,	Mass,
	Platform Elements	Estimating Basis	watts	kg
-:	Payload Equipment	item: 60 Case: III ( $M_{ m PY} \ge 3000$ )	20,050	6,321
2.	Structure - Basic	$M_S = 0.225 \text{ (M}_{PY}) + 300 = 1722 \text{ kg}$	0	2,674
	- Secondary	$108 \text{ of M}_{S} = 172 \text{ kg}$		
	- T/W Penalty	T/W = 0.31; Penalty = 780 kg		
3,	EPS	$M_E = 0.0609 (P_o) + 200 = 1808 \text{ kg}$		1,808
		$P_{E} = 0.067 (P_{o}) + 100 = 1869 W$	1,869	
4.	A.C.S.	$M_A = 0.0294  (M_{PL}) + 64 = 596  \text{kg}$		296
		$P_A = 6.011 \text{ (M}_{PL}) + 30 = 229 \text{ W}$	229	
5.	RCS $M_{\rm p} = 0.166  (M_{\rm pt})$	$M_{ m R} = 1.2 \; (M_{ m P}) = 1.2 \times (3003) = 3604 \; { m kg}$		3,604
	$M_{B} = M_{P} + 0.2 M_{P}$	$P_{R} = 0.008 \text{ (M}_{PY}) + 20 = 71 \text{ W (M}_{PY} \ge 4400)$	7.1	
6.	TCC	$M_T = 0.6263  (M_{PY}) + 77 = 243  \text{kg}$		243
		$P_T = 0.0195 \text{ (M}_{PY}) + 40 = 163 \text{ W}$	163	
7.	TCS	$M_{H} = 0.0175  (M_{PY}) + 52 = 163  \text{kg}$		163
		$P_{H} = 0.0438 \text{ (M}_{PY}) + 100 = 377 \text{ W}$	377	
8	Rendezvous and Docking	$M_{RD} = 0.0193 \; (M_{PY}) + 200 = 322 \; kg$		322
		$\frac{P}{RD} = 200 \text{ W}$	200	
		Sub Tot	22,959	15,730
9.	Contingency and Integration	15% of the above power and mass	3,444	2,360
2		TOTALS	P O 26, 403	MPL 18.090
S	NO. OF PLAIFORMS: 2	- CHUTOT	101,00	200

₽4	PLATFORM MASS & POWER ESTIMATES		PLATFORM NO. 45kC	O. 45kC
0	OTV: 2 STG, OTV, L.T. Expendable	OPER. MODE:C - Non-serviced,	16 year life	
	Platform Elements	Estimating Basis	Power,	Mass, kg
	l. Payload Equipment	Item: 61 Case: III (M <sub>DV</sub> > 3000)	15,500	4,489
6.4	2. Structure - Basic	$M_{_{\rm D}} = 0.225  (M_{_{\rm DV}}) + 300 = 1310  {\rm kg}$	0	1,441
	Secondary	$108 \text{ of M}_{c} = 131 \text{ kg}$		
	- T/W Penalty	T/W = 0.02; Penalty = 0 kg		
6	3. EPS	$M_E = 0.0713 (P_o) + 240 = 1689 \text{ kg}$		1,689
		$P_{E} = 0.067 (P_{O}) + 100 = 1462 W$	1,462	
	4. ACS	$M_A = 0.0294  (M_{PL}) + 64 = 597  \text{kg}$		597
G-66		$P_A = 0.011  (M_{PL}) + 30 = 229  W$	229	
	5. RCS $M_p = 0.332  (M_{pL})$	$M_{B} = 1.2  (M_{D}) = 1.2 \times (6022) = 7227  \text{kg}$		7,227
	$M_{\mathbf{R}} = M_{\mathbf{P}} + 0.2 M_{\mathbf{P}}$	$P_{\rm R} = 0.008 \; (M_{\rm PV}) + 20 = 56 \; \text{W} \; (M_{\rm DV} \ge 4400)$	26	
. 9	TCC	$M_{\rm T} = 0.0263  (M_{\rm PY}) + 77 = 195  \text{kg}$		195
			128	
7.	. TCS	$M_{H} = 0.0175  (M_{PY}) + 52 = 131  kg$		131
		11	2.97	
œ	. Rendezvous and Docking	N/A	N/A	N/A
,		Sub Tot	17,671	15,769
9.	. Contingency and Integration	15% of the above power and mass	2,651	2,365
			۵	2
N.			0	$^{ m MPL}$
Z	NO. OF FLATFORMS: 3	TOTALS:	20,322	18,134

PLATFORM MASS & FOREN ESTATEMENT	OPER MODE: C - Non-serviced, 16 year life	year life	
OTV: 2 STG. OIV Expendable		Domon	Mass
Distform Flements	Estimating Basis	watts	kg
Payload Equipment	Item: 62 Case: III (Mpy > 3000)	20,050	6,321
Structure - Basic	$M_S = 0.225  (M_{PY}) + 300 = 1722  \text{kg}$	0	1,894
- Secondary	$108 \text{ of M}_{S} = 172 \text{ kg}$		
- T/W Penalty	T/W = 0.22; Penalty = 0 kg		
Z C C	$M_{\odot} = 0.0713 (P_{\odot}) + 240 = 2111 \text{ kg}$		2,111
	11	1,858	
SOV	$E = 0.0294 \text{ (M}_{DY}) + 64 = 783 \text{ kg}$		783
	11	299	
$RCS M = 0.332 (M_{\odot})$	A $_{\rm PL}$ M = 1.2 (M $_{\rm p}$ ) = 1.2 × (8116) = 9739 kg		9,739
M = M + 0.2 M	$P_{\rm c} = 0.008 \; (M_{\rm p,v}) + 20 = 71 \; W \; (M_{\rm p,v} \ge 4400)$	7.1	
TCC	$M_{TL} = 0.0263  (M_{DQ}) + 77 = 243  \text{kg}$		243
	$P_{rr} = 0.0195 \text{ (M}_{PrV}) + 40 = 163 \text{ W}$	163	
S	$M_{\odot} = 0.0175  (M_{\odot}) + 52 = 163  \text{kg}$		163
	11	377	
Rendezvous and Docking		N/A	N/A
	Sub Tot	22,818	21,254
Contingency and Integration	15% of the above power and mass	3,423	3,188
		Ь	$M_{\rm PL}$
	. O I V II O II		

PLA'	PLATFORM MASS & POWER ESTIMATES		PLATFORM NO. 471B	O. 47jB
OTV:	2 STG. CTV, L.T. Reusable	OPER. MODE: B - Non-serviced, 8 yr life, replaced	8 yr life,	replaced
	Dlafform Elements	Estimating Basis	Power, watts	Mass, kg
-	Pavload Equipment	Item: 63 Case: III (M <sub>CK</sub> , > 2200)	20,050	4,900
2	Structure - Basic	$M_{\rm c} = 0.29 \; (M_{\rm pv}) + 300 = 1721 \; \text{kg}$	0	1,893
	- Secondary	$10\% \text{ of M}_{S} = 172 \text{ kg}$		
	- T/W Penalty	T/W = 0.03; Penalty = 0 kg		
3.	EPS	$M_{\rm F} = 0.055 \; (P_{_{\rm O}}) + 187 = 1615 \; {\rm kg}$		1,615
		$P_{E} = 0.067 (P_{O}) + 100 = 1840 W$	1,840	
4.	ACS	$M_A = 0.0228  (M_{PL}) + 50 = 359  \text{kg}$		359
		$P_A = 0.011  (M_{PL}) + 30 = 179  W$	179	
5.	RCS $M_{\rm p} = 0.166  (M_{\rm PL})$	$M_{\rm R} = 1.2  (M_{\rm p}) = 1.2  \times (2249) = 2699  \text{kg}$		2,699
	$M_{\mathbf{p}} = M_{\mathbf{p}} + 0.2 M_{\mathbf{p}}$	$P_{R} = 0.008 \text{ (M}_{PY}) + 20 = 59 \text{ W (M}_{PY} \ge 4400)$	29	
.9	TCC	$M_T = 0.026 \text{ (M}_{PY}) + 60 = 187 \text{ kg}$		187
		11	136	
7.	TCS	$M_{H} = 0.0175  (M_{PY}) + 40 = 126  \text{kg}$		126
		$P_{\overline{H}} = 0.0438 \text{ (M}_{\overline{PY}}) + 100 = 315 \text{ W}$	315	
00	Rendezvous and Docking	N/A	A/N	N/A
		Sub Tot	22,578	11,778
9.	Contingency and Integration	15% of the above power and mass	3,387	1,767
			ч°	$^{ m M_{PL}}$
ON	NO. OF PLATFCRMS: 2	TOTALS:	25,964	13,545
-				

PLATFORM MASS & POWER ESTIMATES OTV: 2 STG. OTV, L.T. Reusable

r consumables er, Mass,		1,900	1,678	401	636	212	141	11,618	1,743 M <sub>Dr</sub>
supply 3 yr consumables  Power, Mass	20,050		1,860	177	1400) 64	147	2600) 341	22,840	3,426 P
Estimatin	Item: 64 Case: III ( $M_{\rm PY} \ge 2700$ ) $M_{\rm S} = 0.259  (M_{\rm PY}) + 300 = 1728  {\rm kg}$	$T/W = 0.03$ ; Penalty = 0 kg $M_{\rm E} = 0.0620~({\rm P}) + 210 = 1929~{\rm P}$	$\frac{P}{E} = 0.057 (P_{o}) + 100 = 1860 W$ $M_{A} = 0.0258 (A_{o}) + 56 = 401 Y$		$P_{R} = 0.008 \text{ (M}_{PY}) + 20 = 64 \text{ W (M}_{PY} > 4400)$ $M_{T} = 0.0262 \text{ (M}_{QY}) + 68 = 212 \text{ Fe}$	$P_{\rm T} = 0.0195 \; (M_{ m PY}) + 40 = 147 \; W$ $M_{ m H} = 0.0175 \; (M_{ m H}) + 45 = 147 \; W$	$P_{\rm H} = 0.0438 \; (M_{\rm PY}) + 100 = 341 \; W \; (M_{\rm PY} \ge 2600)$ $M_{\rm RD} = 0.0388 \; (M_{\rm PY}) + 400 = 614 \; {\rm kg}$ $P_{\rm PD} = 200 \; W$		
	Structure - Basic - Secondary	T/W Penalty		$= 0.0623 \text{ (M}_{PL})$	$^{-\text{M}}_{\mathrm{P}}$ + 0.2 M $_{\mathrm{P}}$		Rendezvous and Docking	Contingency and Integration	2

PLATFORM MASS & POWER ESTIMATES

DIATEORM NO 471B	THE TOTAL NO.	OPER. MODE: B - Non-serviced, 8 year life, replaced
LALFORM MASS & POWER ESTIMATES	OTV: 2 STG. OTV Rousshle	Diduction of the state of the s

1		OPER, MODE: B - Non-serviced, 8 year life, replaced	8 year life,	replaced
İ	Platform Elements	Estimating Basis	Power,	Mass,
-	1. Payload Equipment	Item: 65 Case: III (M <sub>r.r.</sub> > 2200)	90 050	9.
	. Structure - Basic	Y = N 9 0 = M	000,00	4,900
	· ·	"s - 5.3 ("Py) + 300 - 1721 kg	0	2,673
	secondary	10%  of M = 172  kg		
	- T/W Penalty	T/W = 0.31; Penalty = 780 kg		
e,	. EPS	$M_{\rm E} = 0.055 \; (P_{\odot}) + 187 = 1616 \; kg$		•
		$P_{rr} = 0.067 \text{ (P)} + 100 = 1841 \text{ W}$		1,616
4.	. ACS	M = 0 0000 M	1,841	
G-		A		386
		$_{\rm A}^{\rm P} = 0.011 \; ({\rm M}_{\rm PL}) + 30 = 192 \; {\rm W}$	192	
	KCS M	$M_R = 1.2 (M_p) + 1.2 \times (2449) = 2939 \text{ kg}$		9 939
		$P_{R} = 0.008 \text{ (M}_{PV}) + 20 = 59 \text{ W (M}_{PV} > 4400)$	29	
9	Tec	$M_T = 0.026  (M_{PY}) + 60 = 187  \text{kg}$		187
t		$P_{\rm T} = 0.0195 \; (M_{\rm PV}) + 40 = 136 \; W$	136	
	res	$M_H = 0.0175  (M_{PY}) + 40 = 126  \text{kg}$		126
c		$P_{H} = 0.0438 \ (M_{PY}) + 100 = 315 \ W$	315	
Ö	Kendezvous and Docking	N/A	N/A	N/A
σ		Sub Tot	22,592	12,827
	containgency and integration	15% of the above power and mass	3,389	1,924
			۵	2
ON	NO. OF PLATFORMS: 2	. S 14 TOT	0,000	Td <sub>w</sub>
		COLAIDA	186,62	14,751

OTV: 2 STG. OTV, Reusable

OPER. MODE: E-serviced, 16 yr life, 3 yr consumables supply

			Power,	Mass,
	Platform Elements	Estimating Basis	watts	kg
	Payload Equipment	Item: 66 Case: III ( $N_{PY} \ge 2700$ )	20,050	5,512
2.	Structure - Basic	$M_S = 0.259  (M_{PY}) + 300 = 1728  \text{kg}$	0	2,680
	- Secondary	$108 \text{ of M}_{\rm S} = 173 \text{ kg}$		
	- T/W Penalty	T/W = 0.31; Penalty = 780 kg		
3.	EPS	$M_{\rm E} = 0.0620 \; (P_{_{ m O}}) + 210 = 1839 \; { m kg}$		1,839
		$P_{\rm E} = 0.067 \; (P_{\rm O}) + 100 = 1861 \; W$	1,861	
4.	ACS	$M_A = 0.0258  (M_{PL}) + 56 = 427  \text{kg}$		427
		$P_A = 0.011  (M_{PL}) + 30 = 188  W$	188	
5.	RCS $M_{\rm p} = 0.0623 \; (M_{\rm PL})$	$M_{\rm R} = 1.2 \; (M_{\rm p}) = 1.2 \times (896) = 1075 \; {\rm kg}$		1,075
	11	$P_{R} = 0.008 \text{ (M}_{PY}) + 26 = 64 \text{ W (M}_{PY} \ge 4400)$	64	
6.	TCC	$M_T = 0.0262  (M_{PY}) + 68 = 212  \text{kg}$		212
		$P_T = 0.0195  (M_{PV}) + 40 = 147  W$	147	
7	TCS	$M_{H} = 0.0175  (M_{PY}) + 45 = 141  \text{kg}$		141
		$P_{H} = 0.0438 \text{ (M}_{PY}) + 100 = 341 \text{ W (M}_{PY} \ge 2600)$	341	
8	Rendezvous and Docking	$M_{RD} = 0.0388 \text{ (M}_{PY}) + 400 = 614 \text{ kg}$		614
		$P_{RD} = 200 \text{ W}$	200	
		Sub Tot	22,852	12,501
9.	Contingency and Integration	15% of the above power and mass	3,428	1,875
			$^{\mathrm{P}}_{\mathrm{o}}$	$M_{ m PL}$
5	9	TOTALS:	26,280	14,377

			Power,	MASB,
	Platform Elements	Estimating Basis	watts	kg
	Payload Equipment	Item: 67 Case: III (Mpy > 3000)	20,050	6,321
2.	Structure - Basic	$M_S = 0.225  (M_{PY}) + 300 = 1722  \text{kg}$	0	1,894
	- Secondery	108  of M = 172  kg		
	- T/W Penalty	T/W = 0.02; Penalty = 0 kg		
3.	EPS	$M_{\rm g} = 0.0609 \; (P_{_{\rm O}}) + 200 = 1807 \; {\rm kg}$		1,807
		$P_{\rm E} = 0.067 \; (P_{\rm O}) + 100 = 1868 \; W$	1,868	
4.	ACS	$M_A = 0.0294  (M_{PL}) + 64 = 560  \text{kg}$		260
		$\Gamma_{A} = 0.011 \text{ (M}_{DL}) + 30 = 216 \text{ W}$	216	
5.	RCS $M_{\rm B} = 0.166  (M_{\rm BJ})$	$M_{\rm D} = 1.2  (M_{\rm D}) = 1.2  \times (2801) = 3361  \text{kg}$		3,361
	$M_{\mathbf{P}} = M_{\mathbf{P}} + 0.2 M_{\mathbf{P}}$		7.1	
9	TCC			243
		$P_T = 0.0195 \; (M_{PY}) + 40 = 163 \; W$	163	
7.	TCS			163
		$P_{H} = 0.0438 \text{ (M}_{PV}) + 100 = 377 \text{ W}$	377	
8	Rendezvous and Docking			322
		$P_{\rm BD} = 200 \text{ W}$	200	
		Sub Tot	22,944	14,672
9.	Contingency and Integration	15% of the above power and mass	3,442	2,201
			ь	$M_{\rm PL}$
5	6	TOTALS:	386 36	16 879

	C' - Non-se
	OPER MODE:
PLATFORM MASS & POWER ESTIMATES	Orv. 2 STG. OTV, Expendable

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PL OT	PLATFORM MASS & POWER ESTIMATES OTV: 2 STG. OTV, Expendable	C' - Non-serviced, OPER. MODE: <u>replenished at 8 y</u>	PLATFORM NO. 48mC' 16 yr life, consumables	O. 48mC'
	Platform Elements	Estimating Basis	Power, watts	Mass, kg
-	Payload Equipment	Item: 68 Case: III ( $M_{\mathrm{pY}} \ge 3000$ )	20,050	6,321
2.	Structure - Basic	$M_{\rm S} = 0.225 \; (M_{ m PY}) + 300 = 1722 \; { m kg}$	0	1,894
	<ul><li>Secondary</li><li>T/W Penalty</li></ul>	10% of $M_S = 172 \text{ kg}$ T/W = 0.22; Penalty = 0 kg		
3.	EPS	$M_{E} = 0.0609 (P_{O}) + 200 = 1807 \text{ kg}$		1,807
		$\frac{P}{E} = 0.067 \ (P) + 100 = 1868 \ W$	1,868	
4.	ACS	$M_A = 0.0294 \text{ (M}_{PL}) + 64 = 560 \text{ kg}$		260
		$P_A = 6.011 \text{ (M}_{PL}) + 30 = 216 \text{ W}$	216	
5.	RCS	$M_{ m R}$ = 1.2 (M $_{ m p}$ ) = 1.2 × (2801) = 3361 kg		3,361
	$M_{\mathbf{R}} = M_{\mathbf{P}} + 0.2 M_{\mathbf{P}}$	$P_{ m R}$ = 0.008 (M $_{ m PY}$ ) + 20 = 71 W (M $_{ m PY}$ $\ge$ 4400)	7.1	
ŝ.	TCC	$M_{T} = 0.0263 \text{ (M}_{PY}) + 77 = 243 \text{ kg}$		243
		$P_{T} = 0.0195  (M_{PY}) + 40 = 163  W$	163	
7.	TCS	$M_{H} = 0.0175  (M_{PY}) + 52 = 163  kg$		163
		$P_{ m H} = 0.0438~({ m M}_{ m P, Y}) + 100 = 377~W$	377	
8	Rendezvous and Docking	$M_{ m RD}$ = 0.0193 ( $M_{ m PY}$ ) + 200 = 322 kg		322
		$P_{RD} = 200 \text{ W}$	200	
		Sub Total	22,944	14,372
9.	Contingency and Integration	15% of the above power and mass	3,442	2,201
			Ь	Σ <sup>-</sup>
NO	NO. OF PLATFORMS: 2	TOTALS:	26,386	16,872

PL	PLATFORM MASS & POWER ESTIMATES		PLATFORM NO. 49kB	). 49kB
0T	OTV: 2 STG. OTV, L.T. Expendable	ble OPER. MODE: B - Non-serviced, 8 yr life, replaced	yr life, rep	laced
	Platform Elements	Estimating Basis	Power, watts	Mass, kg
-:	Payload Equipment	Item: 69 Case: III ( $M_{\rm py} \ge 2200$ )	20,050	4,900
2.	Structure - Basic	$M_g = 0.29  (M_{PV}) + 300 = 1721  \text{kg}$	0	1,893
	- Secondary	$108 \text{ of M}_{S} = 172 \text{ kg}$		
	- T/W Penalty	T/W = 0.02; Penalty = 0 kg		
3.	EPS	$M_E = 0.055 (P_O) + 187 = 1615 \text{ kg}$		1,615
		$P_{E} = 0.067 (P_{O}) + 100 = 1840 W$	1,840	
4.	ACS	$M_{\Lambda} = 0.0228 \text{ (M}_{PL}) + 50 = 359 \text{ kg}$		359
		$P_A = 0.011 \text{ (M}_{DL}) + 30 = 179 \text{ W}$	179	
5.	RCS $M_{D} = 0.166  (M_{DI})$	$M_{\rm B} = 1.2  (M_{\rm p}) + 1.2 \times (2249) = 2699  \rm kg$		2,699
	$M_{\mathbf{D}} = M_{\mathbf{D}} + 0.2 M_{\mathbf{D}}$	$P_{B} = 0.008 \text{ (M}_{PV}) + 20 = 59 \text{ W (M}_{PY} \ge 4400)$	29	
6.	TCC	$M_T = 0.026  (M_{PY}) + 60 = 187  \text{kg}$		187
		$P_T = 0.0195 \ (M_{PV}) + 40 = 136 \ W$	136	
7.	TCS	$M_{H} = 0.0175 \ (M_{PY}) + 40 = 126 \ kg$		126
		$P_{H} = 0.0438 \text{ (M}_{PY}) + 100 = 315 \text{ W}$	315	
8	Rendezvous and Docking	_	N/A	N/A
		Sub Tot	22,578	11,778
9.	Contingency and Integration	15% of the above power and mass	3,387	1,767
			ď	M
N	NO. OF PLATFORMS: 2	TOTALS:	25,964	13,545

PLATFORM NO. 49kE

OTV:	OTV: 2 STG. OTV, L.T. Expendable	able OPER. MODE: E-serviced, 16 yr life, 3 yr consumables supp	e, 3 yr cons	umables supp
	Platform Elements	Estimating Basis	Power, watts	Mass, kg
1.	Payload Equipment	Item: 70 Case: III (M <sub>PV &gt;2</sub> 7700)	20,050	5,512
2.	Structure - Basic	$M_g = 0.259  (M_{PY}) + 300 = 1728  \text{kg}$	0	1,900
	- Secondary	$108 \text{ of M}_{S} = 173 \text{ kg}$		
	- T/W Penalty	T/W = 0.02; Penalty = 0 kg		
3.	EPS	$M_{\overline{F}} = 0.0620 \; (P_{o}) + 210 = 1838 \; kg$		1,838
		$P_{\rm E} = 0.067 \ (P_{\rm O}) + 100 = 1860 \ W$	1,860	
4.	ACS	$M_A = 0.0258  (M_{PL}) + 56 = 401  \text{kg}$		401
		$P_A = 0.011 \text{ (M}_{PL}) + 30 = 177 \text{ W}$	177	
5.	RCS $M_{\rm p} = 0.0623  (M_{\rm pL})$	$M_{\rm B} = 1.2  (M_{\rm P}) = 1.2 \times (833) = 999  \text{kg}$		666
	$M_{\mathbf{B}} = M_{\mathbf{D}} + 0.2 M_{\mathbf{B}}$	$P_{R} = 0.008 \text{ (M}_{PY}) + 20 = 64 \text{ W (M}_{PY} \ge 440 \text{ G})$	64	
9		$M_T = 0.0262  (M_{PY}) + 68 = 212  \text{kg}$		212
		$P_T = 0.0195 \ (M_{PY}) + 40 = 147 \ W$	147	
7.	TCS	$M_{H} = 0.0175  (M_{PV}) + 45 = 141  \text{kg}$		141
		$P_{H} = 0.0438 \text{ (M}_{PY}) + 100 = 341 \text{ W (M}_{PY} \ge 2600)$	0) 341	
8	Rendezvous and Docking	$M_{RD} = 0.0388  (M_{PY}) + 400 = 614  \text{kg}$		614
		$P_{BD} = 200 \text{ W}$	200	
		Sub Tot	22,840	11,618
9.	Contingency and Integration	15% of the above power and mass	3,426	1,743
			P o	$^{ m M}_{ m PL}$
S	NO. OF PLATFORMS: 2	TOTALS:	26,266	13,361

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 50mB

	Estimating Basis	Power,	Mass,
1. Payload Equipment	Item: 71 Case: II ( $M_{\rm py} \ge 2200$ )	37,780	9,250
2. Structure - Basic	$M_S = 0.29  (M_{PV}) + 300 = 2983  \text{kg}$	0	3,281
- Secondary	$10\% \text{ of M}_{S} = 298 \text{ kg}$		
- T/W Penalty			
3. EPS	$M_E = 0.055 (P_O) + 187 = 2860 \text{ kg}$		2,860
	$\frac{P_{\rm E}}{E} = 0.067 \; (\frac{P_{\rm o}}{O}) + 100 = 3356 \; W$	3,356	
4. ACS			611
	$P_A = 0.011 \text{ (M}_{PL}) + 30 = 301 \text{ W}$	301	
5. RCS $M_p = 0.166 (M_{pL})$	$M_{R} = 1.2 \text{ (M}_{P}) = 1.2 \times (4088) = 4905 \text{ kg}$		4,905
$M_R = M_P + 0.2 M_P$	$P_{\rm R} = 0.008 \; ({\rm M_{PV}}) + 20 = 94 \; {\rm W} \; ({\rm M_{PV}} \geq 4400)$	94	
6. TCC	$M_T = 0.026  (M_{PY}) + 60 = 301  \text{kg}$		301
	$P_T = 0.0195 \text{ (M}_{PY}) + 40 = 220 \text{ W}$	220	
7. TCS	$M_{ m H} = 0.0175 \; (M_{ m PY}) + 40 = 202 \; { m kg}$		202
	$P_{H} = 0.0438  (M_{PY}) + 100 = 505  W$	202	
8. Rendezvous and Docking	N/N	N/A	N/A
	Sub Tot	42,257	21,409
9. Contingency and Integration	ation 15% of the above power and mess	6,339	3,211
		<u>а</u> °	M
NO. OF PLATFORMS: 1	TOTALS:	48,595	24,621

PLATFORM MASS & POWER ESTIMATES

OTV: 2 STG. OTV, Expendable

OPER MODE, F. Commission of the Commission of th

Structure - Basic $M_S=0$ .  Structure - Basic $M_S=0$ .  - Secondary $M_S=0$ .  EPS $M_P=0.0623~(M_{\rm PL})$ $M_R=0$ .  RCS $M_P=0.0623~(M_{\rm PL})$ $M_R=0$ .  TCC $M_P=0.0623~(M_{\rm PL})$ $M_R=0$ .  TCC $M_P=0.0623~(M_{\rm PL})$ $M_R=0.023$ .	$72 \text{ Case: III } (M_{\text{PY}} \ge 2706) \qquad 37,780$ $.259 (M_{\text{PY}}) + 300 = 2995 \text{ kg} \qquad 0$ $M_{\text{S}} = 300 \text{ kg}$ $0.22; \text{ Penalty } = 0 \text{ kg}$ $0620 (P_{\text{O}}) + 210 = 3244 \text{ kg}$ $067 (P_{\text{O}}) + 100 = 3379 \text{ W}$ $3,379$ $0258 (M_{\text{PL}}) + 56 = 673 \text{ kg}$ $2 (M_{\text{D}}) = 1.2 \times (1489) = 1787 \text{ kg}$	ts kg 0 10,406 0 3,295
Structure - Basic Ms - Secondary 109 - T/W Penalty T/F EPS ACS Mp = 0.0623 (MpL) MR Mp + 0.2 Mp P RCS Mp = 0.0623 (MpL) Mp P P P P P P P P P P P P P P P P P P	282	
EPS $= \text{Secondary}$ $= \text{T/W Penalty}$ $= \text{T/W Penalty}$ $= \text{T/W Penalty}$ $= \text{T/W Penalty}$ $= \text{EPS}$ $= \text{ACS}$	50 20 21	•
EPS $= T/W \text{ Penalty} \qquad T/$ $= T/W \text{ Penalty} \qquad T/$ $= RCS$	200	
EPS - T/W Penalty T/P    ACS    RCS    RCS $M_P = 0.0623 (M_{PL})$ $M_R = M_P + 0.2 M_P$ TCC $M_R = M_P + 0.2 M_P$ TCC $M_R = M_P + 0.2 M_P$ TCC $M_R = M_P + 0.2 M_P$ $M_R = M_R$ TCC $M_R = M_R + 0.2 M_P$ $M_R = M_R$ TCC $M_R = M_R + 0.2 M_P$ $M_R = M_R$ TCC $M_R = M_R + 0.2 M_P$ $M_R = M_R$ TCC $M_R = M_R + 0.2 M_P$ $M_R = M_R$ TCC $M_R = M_R + 0.2 M_P$ $M_R = M_R$ TCC $M_R = M_R + 0.2 M_P$ $M_R = M_R$ TCC $M_R = M_R + 0.2 M_P$ $M_R = M_R$ TCC $M_R = M_R + 0.2 M_P$ $M_R = M_R$ TCC $M_R = M_R + 0.2 M_P$ $M_R = M_R$	787	
EPS  ACS  ACS  ACS  AACS  RCS $M_{\rm p} = 0.0623  (M_{\rm pL})$ $M_{\rm R} = M_{\rm p} + 0.2  M_{\rm p}$ $M_{\rm rcs}$ $M_{\rm rcs}$	787	
ACS  ACS  RCS $M_{\rm p} = 0.0623  (M_{\rm pL})$ $M_{\rm R} = M_{\rm p} + 0.2  M_{\rm p}$ $M_{\rm T}$ $M_{\rm T}$	787	
ACS $M_{\rm P} = 0.0623  (M_{\rm PL})$ $M_{\rm A}$ $M_{\rm R} = M_{\rm P} + 0.2  M_{\rm P}$ $M_{\rm T}$ $M_{\rm T}$	787	2. 244
RCS $M_{\rm p} = 0.0623 \; (M_{\rm pL})$ $M_{\rm p}$ $M_{\rm p} = 0.0623 \; (M_{\rm pL})$ $M_{\rm p}$	1787	
RCS $M_{\rm P} = 0.0623 \; (M_{\rm PL})$ $^{\rm M}_{\rm R}$ $^{\rm M}_{\rm R} = M_{\rm P} + 0.2 \; M_{\rm P}$ $^{\rm P}_{\rm R}$ $^{\rm P}_{\rm R}$ $^{\rm P}_{\rm R}$	1787 15	
RCS $M_{\rm P} = 0.0623  (M_{\rm PL})$ $M_{\rm R}$ $M_{\rm P} + 0.2  M_{\rm P}$ $M_{\rm P}$ $M_{\rm T}$	1787 1.0	073
$M_{R} = M_{P} + 0.2 M_{P} \qquad P_{R}$ $TCC \qquad M_{T}$		
M MT P T L	av loui	1,787
$\begin{array}{c} M \\ T \\ T \end{array}$	$= 103 \text{ W (M}_{PV} \ge 4400)$ 103	
P T	= 341 kg	341
	0 = 243 W	0.11
$M_{\rm H} = 0.0175  (M_{\odot}) + 45 = 227  k_{\odot}$		
PY PY	a v	227
Rendezvous and Docking $^{\rm F}_{ m H}=0.0438~({ m M}_{ m PY})$ +	= $0.0438  (M_{\rm PY}) + 100 = 556  \text{W}  (M_{\rm PY} \ge 2600)$ 556	
$^{ m M}_{ m RJ}$	400 = 804  kg	804
${\rm P_{RD}} = 200 \text{ W}$	200	
Contingency and Integration	Sub Tot 42,554	20,776
136 of the above power and mass	and mass 6,383	3,116
NO. OF PLATFORMS: 1	P O	$^{ m M}_{ m PL}$

PL	PLATFORM MASS & POWER ESTIMATES OTV: Centaur, L. T. Expendable	C' - Non-serviced, OPER, MODE: consumables repleni	PLATFORM NO. 606C' 16 yr life, shed at 8 yrs	10. 606C'
	Platform Elements	Estimating Basis	Dower, watts	Mass, kg
-	Paylead Equipment	Item: 73 Case: II ( $M_{\rm PY}$ < 3000)	6,000	1,367
. 2	Structure - Basic - Secondary	$M_{S} = 0.31 \; (M_{PY}) + 50 = 474 \; kg$ 10% of $M_{S} = 47 \; kg$	0	521
	- T/W Penalty	T/W = 0.19; Inalty = 0 kg		
3,	EPS		654	704
4.	ACS	$r_{ m E} = 0.005~({ m F_O}) + 100 - 0.94~{ m W}$ $ m M_{ m A} = 0.0294~({ m M_{ m PL}}) + 64 = 204~{ m kg}$		204
		$P_{A} = 0.01i \text{ (iM}_{PL}) + 30 = 82 \text{ W}$	82	
5.	RCS $M_{\rm P} = 0.166$ (	$M_{\rm H} = 1.2 \; (M_{\rm P}) = 1.2 \times (791) = 949 \; {\rm kg}$		949
		.5	100	96
. 9	TCC	$P_{\rm T} = 0.0195  (M_{\rm py}) + 40 = 67  \text{W}$	29	
7.	TCS	H	001	92
o	Rendesvans & Docking	$P_{H} = 0.0438 \text{ (M}_{PY}) + 100 = 160 \text{ W}$ $M_{PS} = 0.0193 \text{ (M}_{PY}) + 200 = 226 \text{ kg}$	100	226
ò		$P_{RD} = 206 \text{ W}$ Sub Tot:	200	4,143
9.	Contingency & Integration	15% of the above power and mass	1,079 P	$621$ $^{\rm M}$ $^{\rm PL}$
ž	NO. OF PLATFORMS: 34	TOTALS	8,273	4,195

PL/	PLATFORM MASS & POWER ESTIMATES	ES	PLATFORM NO. 61dC	NO. 61dC
OT	OTV: OTV, L. T. Expendable	OPER. MODE: C - Non-serviced, 16 year lift	, 16 year lift	
	Platform Elements	Estimating Basis	Power, watts	Mass, kg
1.	Payload Equipment	Item: 74 Case: II (M <sub>PY</sub> < 3000)	6,000	1,419
2.	Structure Basic	$M_S = 0.31  (M_{PY}) + 50 = 490  \text{kg}$	0	539
	- Secondary	$10\%$ of $M_S = 49$ kg		
	- T/W Penalty	T/W = 0.07; Penalty = 0 kg		
3.	EPS	$M_{E} = 0.713  (P_{o}) + 240 = 814  kg$		814
		$P_{E} = 0.067 (P_{o}) + 100 = 640 W$	640	
4.	ACS	$M_A = 0.0294  (M_{PL}) + 64 = 264  kg$		264
		$P_A = 0.011 \text{ (M}_{PL}) + 30 = 105 \text{ W}$	105	
5.	RCS $M_{\rm p} = 0.332 \; (M_{\rm pL})$	$M_{R} = 1.2 \text{ (M}_{P}) = 1.2 \times (2223) = 2715 \text{ kg}$		2,715
	$M_{\mathbf{R}} = M_{\mathbf{P}} + 0.2 M_{\mathbf{P}}$	$P_{R} = 0.008 \; (M_{PY}) + 20 = 31 \; W$	31	
		$(M_{PY} < 4400)$		
9.	TCC	$M_T = 0.0319 \; (M_{PY}) + 52 = 97 \; kg$		26
		${ m P}_{ m T} = 0.0195 \; ({ m M}_{ m PY})  + 40 = 68 \; { m W}$	89	
7.	TCS	$M_{H} = 0.0175  (M_{PY}) + 52 = 77  \text{kg}$		77
		$P_{H} = 0.0438 \; (M_{PY}) + 100 = 162W$	162	
8	Rendezvous & Docking	N/A	N/A	N/A
		Sub Tot:	7,006	5,926
9.	Contingency & Integration	15% of the above power and mass	1,051	688
			ч°	$M_{\mathrm{PL}}$
NO	NO. OF PLATFORMS: 33	TOTALS:		6,815

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PLATFORM NO. 62cC'

	Platform Elements	Estimating Basis	Power, watts	Mass, kg
:	Payload Equipment	Item: 75 Case: II ( $M_{\rm p,y}$ < 3000)	6,690	1,703
2.	Structure - Basic	$M_S = 0.31  (M_{PY}) + 50 = 578  \text{kg}$	0	636
	· Secondary	$10\% \text{ of M}_{S} = 58 \text{ kg}$		
	- T/W Penalty	T/W = 0.08; Penalty = 0 kg		
3.	EPS	$M_{E} = 0.0609 (P_{o}) + 200 = 759 kg$		759
		$P_{\rm E} = 0.067 \; (P_{_{\rm O}}) + 100 = 715 \; \text{W}$	715	
4.	ACS	$M_A = 0.0294  (M_{PL}) + 64 = 228  \text{kg}$		228
		$P_A = 0.011  (M_{PL}) + 30 = 91  W$	91	
5.	RCS $M_{\mathbf{p}} = 0.166  (M_{\mathbf{pL}})$	$M_{\rm R} = 1.2  (M_{\rm p}) = 1.2  \times (928) = 1114  \rm kg$		1,114
	$M_{\mathbf{R}} = M_{\mathbf{P}} + 0.2 M_{\mathbf{P}}$	$P_{R} = 0.008  (M_{PY}) + 20 = 34  W  (M_{PY} < 4400)$	34	
9	TCC	$M_T = 0.0319  (M_{PY}) + 52 = 106  kg$		106
		$P_T = 0.0195 \text{ (M}_{PY}) + 40 = 73 \text{ W}$	73	
7.	TCS	$M_H = 0.0175  (M_{PY}) + 52 = 82  \text{kg}$		83
		$P_{H} = 0.0438 \text{ (M}_{PY}) + 100 = 175 \text{ W}$	175	
· ·	Rendezvous & Docking	$M_{RD} = 0.0193  (M_{PV}) + 200 = 233  kg$		233
		$P_{RD} = 200 \text{ W}$	200	
		Sub Tot:	7,977	4,861
9.	Contingency & Integration	15% of the above power and mass	1,197	729
				$^{ m M_{PL}}$
9	NO. OF PLATFORMS: 26	TOTALS:		5,590

OTV: OTV, L. T. Expendable

C' - Non-serviced, PLATFORM No. 63dC'

OPER. MODE: 16 yr life, consumables replenished at 8 yrs

	Platform Elements	Estimating Basis	Power, watts	Mass kg
١.	Payload Equipment	Item: 76 Case: II (Mpy < 3000)	8,500	2,051
	Structure - Basic	$M_S = 0.31  (M_{PY}) + 50 = 686  kg$	0	754
	- Secondary	10% of M <sub>S</sub> = 69 kg		
	- T/W Penalty	T/W 0.07; Penalty = 0 kg		
	EPS	$M_E = 0.0609 (P_O) + 200 = 899 kg$		899
		$P_E = 0.067 (P_Q) + 100 = 869 W$	869	
	ACS	$M_A = 0.0294 (M_{PL}) + 64 = 257 \text{ kg}$		257
		$P_A = 0.011 (M_{PL}) + 30 = 102 W$	102	
	$M_{\mathbf{P}} = 0.166  (M_{\mathbf{PL}})$	$M_{R} = 1.2 (M_{P}) = 1.2 \times (1092) = 1310 \text{ kg}$		1,310
	$M_{R} = M_{P} + 0.2 M_{P}$	$P_{R} = 0.008  (M_{PY}) + 20 = 36  W  (M_{PY} < 4400)$	36	
	TCC	$M_{T} = 0.0319 (M_{PY}) + 52 = 117 kg$		117
		$P_{T} = 0.0195 (M_{PY}) + 40 = 80 W$	80	
	TCS	$M_{H} = 0.0175 (M_{PY}) + 52 = 88 kg$		88
		$P_{H} = 0.0438  (M_{PY}) + 100 = 190  W$	190	
	Rendezvous & Docking	$M_{RD} = 0.0193  (M_{PY}) + 200 = 240  kg$		240
		$P_{RD} = 200 W$	200	
		Sub Tot:	9,977	5,716
	Contingency & Integration	15% of the above power and mass	1,497	857
			P	$^{ m M}_{ m PL}$
О	. OF PLATFORMS: 20	TOTALS		6,574

PLATFORM MASS & POWER ESTIMATES

64gC'	
M NO.	
PLATFORM	D MODE. 16 1:6.
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1. Payload Equipment 2. Structure - Basic  - Secondary  - T/W Penaity  1. FPS  4. ACS  M <sub>P</sub> = 0.166 (M <sub>PL</sub> )  M <sub>R</sub> = M <sub>P</sub> + 0.2 M <sub>P</sub> PP  7. TCS  No. OF PLATFORMS: 14	)TV	OTV: IOTV, L. T. Expendable	OTV: IOTV, L. T. Expendable OPER. MODE: 16 yr life, consumables replenished at 8 yrs	, ibles replenisl	led at 8 yrs
ic ondary Penalty $^{\prime\prime}$ Pen		Platform Elements	Estimating Basis	Power,	Mass, kg
ic and ary beneatly $ \begin{array}{l} \text{Penalty} \\ \text{D.166 (M}_{\text{PL}}) \\ \\ \text{A}_{\text{P}} + 0.2  \text{M}_{\text{P}} \\ \\ \text{cking} \\ \\ \text{tegration} \\ \\ \end{array} $		Payload Equipment	Item: 77 Case: III (M <sub>DV</sub> <3000)	13,400	2,890
ondary Penalty $0.166  (\mathrm{M_{PL}})$		1	$M_S = 0.31  (M_{PV}) + 50 = 946  \text{kg}$	0	1,040
Penalty (Mp. 166 (Mp. $^{\prime}$ ) $^{\prime}_{P}$ + 0.2 $^{\prime}_{P}$ cking tegration (tegration 14		- Secondary	$10\%$ of $M_S = 95 \text{ kg}$		
0.166 ( $^{\rm M}_{ m PL}$ ) $^{\rm A}_{ m P}$ + 0.2 $^{\rm M}_{ m P}$ cking			T/W = 0.06; Penalty = 0 kg		
0.166 ( $^{ m M}_{ m PL}$ ) $^{ m I}_{ m P}$ + 0.2 $^{ m M}_{ m P}$ cking  tegration		EPS	$M_{E} = 0.0609 (P_{o}) + 200 = 1277 \text{ kg}$		1,277
0.166 $(M_{\rm PL})$ $^{\prime}_{\rm P}$ + 0.2 $^{\prime}_{\rm P}$ cking			$P_{E} = 0.057 (P_{O}) \div 100 = 1285 W$	1,285	
1.166 $(M_{\rm PL})$ $^{\prime}_{\rm P}$ + 0.2 $^{\prime}_{\rm P}$		4CS	$M_A = 0.0294  (M_{PL}) + 64 = 329  \text{kg}$		329
0.166 $(M_{\rm PL})$ $A_{\rm P}$ + 0.2 $M_{\rm P}$ cking tegration 14			$P_A = 0.011  (M_{PL}) + 30 = 129  W$	129	
$^{4}_{ m P}$ + 0.2 $^{\rm M}_{ m P}$ cking		$M_{\mathbf{p}} = 0.166$	$M_R = 1.2  (M_p) = 1.2 \times (1496) = 1796  kg$		1,796
cking tegration 14		= M <sub>P</sub> +	$P_{R} = 0.008 \text{ (M}_{PY}) + 20 = 43 \text{ W (M}_{PY} < 4400)$	43	
cking tegration 14			$M_{\rm T} = 0.0319 \; (M_{ m PY}) + 52 = 144 \; { m kg}$		144
cking tegration 14			$P_{T} = 0.0195  (M_{PV}) + 40 = 96  W$	96	
cking tegration 14		CS	$M_{H} = 0.0175  (M_{PY}) + 52 = 103  \text{kg}$		103
cking tegration 14			$P_{H} = 0.0438 \; (M_{PY}) + 100 = 227 \; W$	227	
itegration 14		tendezvous & Docking	$M_{RD}$ = 0.0193 ( $M_{PY}$ ) + 200 = 256 kg		256
itegration 14			$P_{RD} = 200 \text{ W}$	200	
itegration 14			Sub Tot:	15,380	7,835
		ontingency & Integration	15% of the above power and mass	2,307	1,175
				Ь	$M_{ m PL}$
	0.		TOTALS: 17,687	: 17,687	9,010

OTV: 2 STG, OTV, Reusable

OPER. MODE: C - Non-serviced, 16 year life

	Platform Elements	Estimating Basis	Power, watts	Mass, kg
1.	Payload Equipment	Item: 78 Case: III (M <sub>PY</sub> ± 3000)	16,600	3,413
2.	Structure - Basic	$M_S = 0.225 (M_{PY}) + 300 = 1069 kg$	0	1,956
	- Secondary	10% of M <sub>S</sub> = 107 kg		
	- T/W Penalty	T/W = 0.31; Penalty = 780 kg		
3.	EPS	$M_E = 0.0713 (P_O) + 240 = 1779 kg$		1,779
		$P_{E} = 0.067 (P_{O}) + 100 = 1546 W$	1,546	
4.	ACS	$M_A = 0.0294 (M_{PL}) + 64 = 562 \text{ kg}$		562
		$P_A = 0.011 (M_{PL}) + 30 = 217 W$	217	
5.	RCS $M_p = 0.332 (M_{PL})$	$M_{R} = 1.2 (M_{p}) = 1.2 \times (5629) = 6755 k$	g	6,755
	$M_{R} = M_{P} + 0.2 M_{P}$	$P_{R} = 0.008 (M_{PY}) + 20 = 47 W$	47	
		$(M_{PY} < 4400)$		
6.	TCC	$M_T = 0.0319 (M_{PV}) + 52 = 161 \text{ kg}$		161
		$P_{T} = 0.0195 \ (M_{PY}) + 40 = 107 \ W$	107	
7.	TCS	$M_{H} = 0.0175 (M_{PY}) + 52 = 112 kg$		112
		$P_{H} = 0.0438 \ (M_{PV}) + 100 = 250 \ W$	250	
8.	Rendezvous & Docking	N/A	N/A	N/A
		Sub Tot:	18,766	14,743
9.	Contingency & Integration	15% of the above power and mass	2,815	2,212
NO	. OF PLATFORMS: 12		P O TOTALS: 21,581	M <sub>PL</sub> 16,955

PLATFORM MASS & POWER ESTIMATES

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TFORM NO. 661C'	Power, Mass, kg	5,031		2, 175	535	3,199	209	140	297	13,936	$^2$ ,090 M $_{ m PL}$
C' Non-serviced, PLATFORM NO. 661C' OPER. MODE: 16 yr life, consumables replenished at 8 yrs	Estimating Basis	Item: 79 Case: III ( $M_{PY} \ge 3000$ ) 25,000 $M_S = 0.225 (M_{PY}) + 300 = 1432 \text{ kg}$ 0	T/W = 0.31; Penalty = 780 kg $M_E = 0.0609 (P_O) + 200 = 2175 kg$	$P_{E} = 0.067 (P_{o}) + 100 = 2273 W$ 2,273 M $A = 0.0294 (M_{o}) + 64 = 535 kg$	$P_{A} = 0.011 (M_{PL}) + 30 = 206 W$ 206	$^{199}~\mathrm{kg}$ $_{\mathrm{Y}} \stackrel{>}{\scriptscriptstyle \sim} 4400)$	$^{1}$ T $^{-}$ 0.0203 ( $^{1}$ M $_{PY}$ ) + 77 = 209 kg $^{-}$ F $^{-}$ = 0.0195 ( $^{1}$ M $_{PY}$ ) + 40 = 138 W 138	$^{''}_{M}H = 0.0173 \text{ (M}_{PY}) + 52 = 140 \text{ kg}$ $^{P}_{H} = 0.0438 \text{ (M}_{PY}) + 100 = 320 \text{ W}$ 320 $^{M}_{DY} = 0.0193 \text{ (M}_{PY}) + 200 = 967 \text{ kg}$	$P_{RD} = 200 \text{ W}$ $P_{TD} = 200 \text{ W}$	Sub Tot: 28,198	4,230 P
OTV: 2 STG OTV, Reusable	Platform Elements 1. Payload Equipment		3. EPS	4. ACS	5. RCS $M_{\rm p} = 0.166  (M_{\rm DI})$	$M_{R} = M_{P} + 0.2 M_{P}$ 6. TCC	7. TCS	8. Rendezvous & Docking		9. Contingency & Integration	NO. OF PLATFORMS: 7

OTV: 2 STG OTV, Expendable OPER. MODE: C - Non-serviced, 16 year life

	Platform Elements	Estimating Basis	Power, watts	Mass, kg
1.	Payload Equipment	Item: 80 Case: III (Mpy \geq 3000)	29,200	6,102
2.	Structure - Basic	$M_S = 0.225  (M_{PY}) + 300 = 1673  kg$	0	1,840
	- Secondary	10% of M <sub>S</sub> = 167 kg		
	- Γ/W Penalty	T/W = 0.22; Penalty = 0 kg		
3.	EPS	$M_E = 0.0713 (P_O) + 240 = 2940 \text{ kg}$		2,940
		$P_{E} = 0.067 (P_{O}) + 100 = 2637 W$	2,637	
4.	ACS	$M_A = 0.0294 (M_{PL}) + 64 = 819 \text{ kg}$		819
		$P_A = 0.011  (M_{PL}) + 30 = 312  W$	312	
5.	$M_{\mathbf{p}} = 0.332  (M_{\mathbf{pL}})$	$M_{R} = 1.2 (M_{P}) = 1.2 \times (8525) = 10,230$	kg	10,230
	$M_R = M_P + 0.2 M_P$	$P_{R} = 0.008 \text{ (M}_{PY}) + 20 = 69 \text{ W}$	69	
		$(M_{PY} \ge 4400)$		
6.	TCC	$M_{T} = 0.0263 (M_{PY}) + 77 = 237 kg$		237
		$P_{T} = 0.0195  (M_{PY}) + 40 = 159  W$	159	
7.	TCS	$M_{H} = 0.0175 (M_{PY}) + 52 = 159 kg$		159
		$P_{H} = 0.0438  (M_{PY}) + 100 = 367  W$	367	
8.	Rendezvous & Docking	N/A	N/A	N/A_
		Sub Tot:	32,924	22,327
9.	Contingency & Integration	15% of the above power and mass	4,939	3,349
NC	O. OF PLATFORMS: 6	TO	P OTALS: 37,863	M <sub>PL</sub> 25,676

PLATFORM NG 681B

OTV: 2 STG OTV Reusable

OPER. MODE: B - Non-serviced, 8 year life, replaced

	Platform Elements	Estimating Basis	Power, watts	Mass, kg
1.	Payload Equipment	Item: 81 Case: III $(M_{PY} \ge 2200)$	31,700	5,350
2.	Structure - Basic	$M_S = 0.29 (M_{PY}) + 300 = 1852 \text{ kg}$	0	2,817
	- Secondary	10% of M <sub>S</sub> = 185 kg		
	- T/W Penalty	T/W = 0.31; Penalty = 780 kg		
3.	EPS	$M_E = 0.055 (P_O) + 187 = 2418 kg$		2,413
		$P_{E} = 0.067 (P_{O}) + 100 = 2818 W$	2,818	
1.	ACS	$M_A = 0.0228 \ (M_{PL}) + 50 = 436 \ kg$		436
		$P_A = 0.011 (M_{PL}) + 30 = 216 W$	216	
	$M_{p} = 0.166 (M_{pL})$	$M_{R} = 1.2 (M_{p}) = 1.2 \times (2811) = 3374 kg$		3,374
	$M_R = M_P + 0.2 M_P$	$P_{R} = 0.008  (M_{PY}) + 20 = 63  W$	63	
		$(M_{PY} \ge 4400)$		
ö.	TCC	$M_{T} = 0.026 (M_{PY}) + 60 = 199 kg$		199
		$P_{T} = 0.0195 (M_{PY}) + 40 = 144 W$	144	
	TCS	$M_{H} = 0.0175 (M_{PY}) + 40 = 134 \text{ kg}$		134
		$P_{H} = 0.0438 \ (M_{PY}) + 100 = 334 \ W$	334	
	Rendezvous & Docking	N/A	N/A	N/A
		Sub Tot:	35,275	14,727
	Contingency & Integration	15% of the above power and mass	5,291	2,209
10	. OF PLATFORMS: 6	тот	P <sub>O</sub> ALS: 40,567	M <sub>PL</sub> 15,936

PLATFORM MASS & POWER ESTIMATES

	OTV: 2 STG OTV, Expendable	C' - Non-serviced, 16 yr life, OPER. MODE: consumables replenished at 8 yrs	PLATFORM 16 yr life, nished at 8 yr	NO. 69mC
I	Platform Elements	Retimotive Deci-	Power,	Mass,
		Estimating Basis	watts	kg
1.	. Payload Equipment	Item: 82 Case: III (M <sub>D.V.</sub> > 3000)	46,080	9.469
2	2. Structure - Basic	$M_S = 0.225 \ (M_{DV}) + 300 = 2431 \ kg$	0.00	2.674
	- Secondary	$10\% \text{ of M}_{\rm Q} = 243 \text{ kg}$		
	- T/W Penalty	T/W = 0.22; Penalty = 0 kg		
e,	. EPS	$M_{E} = 0.0609 \; (P_{o}) + 200 = 3807 \; kg$		3,807
		$P_{E} = 0.067 (P_{o}) + 100 = 4068 W$	4,068	
4.	ACS	$M_A = 0.0294  (M_{PL}) + 64 = 841  kg$		841
-87		$P_{A} = 0.011  (M_{PL}) + 30 = 321  W$	321	
5.	RCS $M_{\rm P} = 0.166  (M_{\rm PL})$			5,266
	$M_{\mathbf{R}} = M_{\mathbf{P}} + 0.2 M_{\mathbf{P}}$	$P_{ m R} = 0.008~(M_{ m p, V}) + 20 = 96~W~(M_{ m p, V} \ge 4400)$	96	
9	TCC	$M_{T} = 0.0263  (M_{PY}) + 77 = 326  \text{kg}$		326
		$P_T = 0.0195  (M_{DV}) + 40 = 225  W$	225	
7.	TCS	$M_H = 0.0175  (M_{PY}) + 52 = 218  \text{kg}$		218
		$P_{H} = 0.0438 \; (M_{P,Y}) + 100 = 515 \; W$	515	
œ	Rendezvous & Docking	$M_{RD} = 0.0193  (M_{PX}) + 200 = 383  kg$		383
		$P_{RD} = 200 \text{ W}$	200	
		Sub Tot:	51,504	22,983
9.	Contingency & Integration	15% of the above power and mass	7,726	3,447
ON	NO. OF PLATFORMS: 4			$^{ m MpL}$
		TOTALS: 59,230		26,430

OTV: 2 STG, OTV, Expendable

OPER. MODE: B - Non-serviced, 8 year life, replaced

	Platform Elements	Estimating Basis	Power, watts	Mass, kg
1.	Payload Equipment	Item: 83 Case: III $(M_{PY} \ge 2200)$	57,280	9,240
2.	Structure - Basic	$M_S = 0.29 (M_{PV}) + 300 = 2980 \text{ kg}$	0	3,278
	- Secondary	10% of M <sub>S</sub> = 298 kg		
	- T/W Penalty	T/W = 0.22; Penalty = 0 kg		
3.	EPS	$M_E = 0.055 (P_O) + 187 = 4198 kg$		4,198
		$P_{E} = 0.067 (P_{O}) + 100 = 4986 W$	4,986	
4.	ACS	$M_A = 0.0228  (M_{PL}) + 50 = 658  \text{kg}$		658
		$P_A = 0.011 (M_{PL}) + 30 = 323 W$	323	
j.	RCS $M_p = 0.166 (M_{PL})$	$M_{R} = 1.2 (M_{p}) 1.2 \times (4427) = 5312 \text{ kg}$		5,312
	$M_{\mathbf{R}} = M_{\mathbf{P}} + 0.2 M_{\mathbf{P}}$	$P_{R} = 0.008 (M_{PY}) + 20 = 94 W$	94	
		$(M_{PY} \ge 4400)$		
ô.	TCC	$M_{T} = 0.026  (M_{PY}) + 60 = 300  kg$		300
		$P_{T} = 0.0195 \ (M_{PY}) + 40 = 220 \ W$	220	
١.	TCS	$M_{H} = 0.0175 (M_{PY}) + 40 = 202 kg$		202
		$P_{H} = 0.0438  (M_{PY}) + 100 = 505  W$	505	
3.	Rendezvous & Docking	N/A	N/A_	N/A
		Sub Tot:	63,408	23,188
).	Contingency & Integration	15% of the above power and mass	9,511	3,478
			P	$^{ m M}_{ m PL}$
NO	. OF PLATFORMS: 3	T	OTALS: 72,919	26,666

PLATFORM MASS & POWER ESTIMATES

PI	PLATFORM MASS & POWER ESTIMATES	TES	PLATFORM NO 70mE	NO 70mE
0.	OTV: 2 STG OTV, Expendable	OPER. MODE: 3 yr consumables supply	ife, upply	
	Platform Elements	Estimating Basis	Power,	Mass,
1.	Payload Equipment	Item: 84 Case: III (M <sub>DV</sub> > 2700)	57,280	10,395
2.	Structure - Basic	$M_{S} = 0.259 \; (M_{PY}) + 300 = 2992 \; kg$	0	3,292
	- Secondary	10% of M <sub>S</sub> = 299 kg		
	- T/W Penalty	T/W = 0.22; Penalty = 0 kg		
3.	EPS	$M_E = 0.0620 (P_o) + 210 = 4752 kg$		4,752
		$P_{E} = 0.067 (P_{o}) + 100 = 5008 W$	5,008	
4.	ACS	$M_A = 0.0258 \ (M_{PL}) + 56 = 722 \ kg$		722
		$P_{A} = 0.01$ ( $M_{PL}$ ) + 30 = 314 W	314	
5.	RCS $M_P = 0.0623  (M_{PL})$	$M_R = 1.2 (M_p) = 1.2 \times (1609) = 1931 kg$		1,931
	$M_{\mathbf{R}} = M_{\mathbf{P}} + 0.2 M_{\mathbf{P}}$	$P_{R} = 0.008  (M_{PY}) + 20 = 103  \text{W}  (M_{PY} \ge 4400)$	103	
. 9	TCC	$M_{T} = 0.0262 \text{ (M}_{pY}) + 68 = 340 \text{ kg}$		340
		$P_{T} = 0.0195  (M_{PY}) + 40 = 243  W$	243	
	TCS	$M_{H} = 0.0175  (M_{PY}) + 45 = 227  \text{kg}$		227
		$P_{ m H}$ = 0.0438 (M $_{ m pY}$ ) + 100 = 555 W (M $_{ m pV}$ $\ge$ 2600)	555	
· ·	Rendezvous & Docking	$M_{RD} = 0.0388  (M_{PY}) + 400 = 803  kg$		803
		$P_{RD} = 200 \text{ W}$	200	,
		Sub Tot:	63,704	22,463
9.	Contingency & Integration	15% of the above power and mass	9,556	3,369
ÇN.				$^{ m M}_{ m PL}$
NO	NO. OF PLAIFORMS: 3	TOTALS: 73,259		25,832

OTV:\_OTV, L. T. Reusable

OPER. MODE: C - Non-serviced, 16 year life

	Platform Elements	Estimating Basis	Power, watts	Mass, kg
1.	Payload Equipment	Item. 85 Case: II (Mpy < 3000)	1,800	320
2.	Structure - Basic	$M_S = 0.31 (M_{PY}) + 50 = 149 \text{ kg}$	0	164
	- Secondary	$10\% \text{ of M}_{S} = 15 \text{ kg}$		
	- T/W Penalty	T/W = 0.13; Penalty = 0 kg		
3.	EPS	$M_E = 0.0713 (P_Q) + 240 = 430 \text{ kg}$		430
		$P_{E} = 0.067 (P_{O}) + 100 = 279 W$	279	
4.	ACS	$M_A = 0.0294 (M_{PL}) + 64 = 137 \text{ kg}$		137
		$P_A = 0.011 (M_{PL}) + 30 = 57 W$	57	
5.	$RCS   M_p = 0.332   (M_{PL})$	$M_R = 1.2  (M_p) = 1.2 \times (826) = 991  kg$		991
	$M_{R} = M_{P} + 0.2 M_{P}$	$P_{R} = 0.008  (M_{PY}) + 20 = 23  W$	23	
		$(M_{PY} < 4400)$		
ő.	TCC	$M_{T} = 0.039 (M_{PY}) + 52 = 62 \text{ kg}$		62
		$P_T = 0.0195 (M_{PY}) + 40 = 46 W$	46	
7.	TCS	$M_{H} = 0.0175  (M_{E_1}) + 52 = 58  \text{kg}$		59
		$P_{H} = 0.0438  (M_{PY}) + 100 = 114  W$	114	
3.	Rendezvous & Docking	N/A	N/A	N/A
		Sub Tot:	2,319	2,163
).	Contingency & Integration	13% of the above power and mass	P <sub>O</sub> 348	$^{324}_{ m PL}$
NO	. OF PLATFORMS: 225	TO	TALS: 2,667	2,487

ESTIMATES
POWER
MASS &
LATFORM

atform Elements  oad Equipment  cture - Basic  - Secondary  - T/W Pchalty  T/W  M,	OPER. MODE: C   NOIL ST.   NOWER	Power, watts 2,420	Mass, kg
nt Item c MS ndary 10% Pcnalty T/M M,	Estimating Basis $86  \text{ase}  11  (M_{\rm PY} < 3000) \\ 0.31  (M_{\rm PY}) + 50 = 186  \text{kg}$	Power, watts 2,420	Mass, kg
Item MS dary 10% Penalty T/M M,	Estimating Basis 86 ase II ( $M_{PY}$ < 3000) 0.31 ( $M_{PY}$ ) + 50 = 186 kg .f M = 19 kg	2,420	9
Item MS dary 10% Ochalty T/M M,	86 ase II ( $M_{PY}$ < 3000) 0,31 ( $M_{PY}$ ) + 50 = 186 kg 6 M = 19 kg	2,420	1
Ms 10% Chary T/W T/W M,,	$0.31 \text{ (M}_{PY}) + 50 = 186 \text{ kg}$ $f_{M} = 19 \text{ kg}$	0	439
dary 10%	.f M = 19 kg	,	352
T/W Penalty T/W	a a. 5m 10		
M.,	T/W = 1.08; Penalty = 147 kg		
	$= 0.0713 (P_1) + 240 = 487 \text{ kg}$		487
H d	= 0.067 (P) + 100 = 332 W	332	
. N	= 0.0294  (M) + 64 = 162  kg		162
ACS	$-6.011 (M_{\odot}) + 30 = 67 W$	67	
A :	= 0.011 (mpL) = $\frac{1}{2}$ = 1324 kg		1,324
RCS $M_{\rm p} = 0.332  (M_{\rm pL})^{-10}  M_{\rm R}$	(dw) 7:1	2.4	
P PR	$= 0.008  (M_{PY}) + 20 = 24  W$	i	
	$(M_{PX} < 4400)$		99
Ç	$M_{m} = 0.0319  (M_{DV}) + 52 = 66  \text{kg}$		00
6. ICC P	$= 0.0195 \text{ (M}_{-1}) + 40 = 49 \text{ W}$	49	
T. N	T $T$ $Y$		09
7. TCS "H	= 0 0438 (M ) + 100 = 119 W	119	
Ε,		N/A	N/A
8. Rendezvous & Docking N/A	Sub Tot:	3,009	3,888
	and mass	451	433
9. Contingency & Integration 13	of the above point	$^{\mathrm{P}_{_{\mathrm{O}}}}$	MPL
631	TOTALS:	S: 3,461	3,321

PLATFORM MASS & POWER ESTIMATES

74aC'	Mass, kg	530	236			554		143		536		69		61		210	-
PLATFORM NO. 16 Yr life, iished at 8 yrs	Power, watts	4,110	0				490		09		24		20		123		200
TES C' - Non-serviced, 16 yr life, OPER, MODE; consumables replenished at 8 yrs	Estimating Basis	Item: 87 Case: II ( $M_{ m p, Y}$ < 3000)	$M_S = 0.31  (M_{PY}) + 50 = 214  \text{kg}$	$10\% \text{ of M}_{S} = 21 \text{ kg}$	$\Gamma/W = 0.13$ ; Penalty = 0 kg	$M_{E} = 0.0609  (P_{o}) + 200 = 554  kg$	$P_{E} = 0.067 (P_{o}) + 100 = 490 W$	$M_A = 0.0294 \ (M_{PL}) + 64 = 143 \ kg$	$P_{A} = 0.011 \text{ (M}_{PL}) + 30 = 60 \text{ W}$	$M_R = 1.2 (M_p) = 1.2 \times (447) = 536 \text{ kg}$	$P_{R} = 0.008 \text{ (M}_{PY}) + 20 = 24 \text{ W (M}_{PV} < 4400)$	$M_T = 0.0319  (M_{PY}) + 52 = 69  \text{kg}$	$P_{T} = 0.0195 \; (M_{PY}) + 40 = 50 \; W$	$M_{H} = 0.0175  (M_{PY}) + 52 = 61  \text{kg}$	$P_{H} = 0.0438 \; (M_{PY}) + 100 = 123 \; W$	$M_{ m RD}$ = 0.0193 ( $M_{ m PY}$ ) + 200 = 210 kg	$P_{RD} = 200 \text{ W}$
PLATFORM MASS & POWER ESTIMATES OTV: OTV, L. T. Reusable	Platform Elements	1. Payload Equipment	2. Structure - Basic	- Secondary		3. EPS		4. ACS		5. RCS $M_{\rm P} = 0.166  (M_{\rm PL})$	$M_{\mathbf{R}} = M_{\mathbf{P}} + 0.2 M_{\mathbf{P}}$	6. TCC		7. TCS		8. Rendezvous & Docking	

2,340

5,057 759

Sub Tot:

15% of the above power and mass

9. Contingency & Integration

NO. OF PLATFORMS: 145

351

 $^{
m M_{PL}}_{2,690}$ 

Po TOTALS: 5,816

.75rC		Mass,
PLATFORM NO. 75rC	16 year life	Power,
	OPER, MODE: C - Non-serviced, 16 year life	
PLATFORM MASS & POWER ESTIMATES	OTV: Centaur, Expendable	

0	V. V.			
			Power,	Mass,
	Platform Elements	Estimating Basis	watts	kg
	tuomining Contract	Item: 88 Case: II (M., < 3000)	3,865	645
-	rayload Eddipment	PY P		675
5.	Structure - Basic	S = 0.31  (Mpy) = 30 = 230  Ag		
	- Secondary	10% of M <sub>S</sub> = 25 kg		
	- T/W Penalty	T/W = 1.76; Penalty = 400 kg		
n	EPS	$M_{\rm D} = 0.0713 \; (P_{\rm O}) + 240 = 618 \; {\rm kg}$		618
		$P_{\rm E} = 0.067 \; (P_{\rm A}) + 100 = 455 \; W$	455	
4	ACS	$M_{A} = 0.0294 \text{ (M}_{DT}) + 64 = 206 \text{ kg}$		206
G-		$P_A = 0.011 \text{ (M}_{DI}) + 30 = 83 \text{ W}$	83	
	RCS	$M_{\rm D} = 1.2  (M_{\rm p}) = 1.2  \times (1608) = 1929  \text{kg}$		1,929
	$M_{\mathbf{p}} = M_{\mathbf{p}} + 0.2 M_{\mathbf{p}}$	$P_{R} = 0.008 \text{ (M}_{PY}) + 20 = 25 \text{ W}$	25	
		$(M_{PV} < 4400)$		
9	TCC	$M_{\rm T} = 0.0319 \; (M_{\rm PV}) + 52 = 73 \; \text{kg}$		73
		$P_{,T} = 0.0195  (M_{D,V}) + 40 = 53  W$	53	
7	TCS	$M_{LI} = 0.0175  (M_{DV}) + 52 = 63  \text{kg}$		63
		$P_{II} = 0.0438 \text{ (M}_{DV}) + 100 = 128 \text{ W}$	128	
œ	Rendezvous & Docking	N/A	N/A	N/A
5		Sub Tot:	4,609	4,210
6	Contingency & Integration	15% of the above power and mass	691	631
		TOT	P O OTALS:	M <sub>PL</sub>
2	NO. OF PLATFORMS: 121		105,6	4,041

TA A A A A	ESTIMATES
-	POWER
	MASS
	LAIFORM

MO
OPER. MO
T. Reusable
L. T.
OTV: OTV, L. T. Reusable

OT	OTV: OIV, L. L. Reusable			
	Platform Elements	Estimating Basis	Power, watts	Mass, kg
-:	Payload Equipment	Item: 89 Case: II (Mpv < 2700)	3,970	653
5.	Structure - Basic	$M_S = 0.35 (M_{PX}) + 50 = 729 \text{ kg}$	0	801
	- Secondary - T/W Penalty	T/W = 0.13; Penalty = 0 kg		
3.	EPS	$M_{E}$ = 0.0620 ( $P_{o}$ ) + 210 = 561 kg		561
		$P_{E} = 0.067 (P_{O}) + 100 = 479 W$	479	
4.	ACS	$M_A = 0.0258 (M_{PL}) + 56 = 139 \text{ kg}$ $P_A = 0.011 (M_{PL}) + 30 = 65 \text{ W}$	65	139
5.	RCS $M_{\rm p} = 0.0623  (M_{\rm PL})$	$M_{B} = 1.2  (M_{P}) = 1.2 \times (200) = 240  \text{kg}$		240
	$M_{R} = M_{P} + 0.2 M_{P}$	$P_{R} = 0.008 \text{ (M}_{PY}) + 20 = 25 \text{ W (M}_{PY} < 4400)$	25	
. 9	TCC	$M_{T}$ = 0.0317 ( $M_{PY}$ ) + 45 = 66 kg		99
		$P_{,T} = 0.0195 \text{ (M}_{PY}) + 40 = 53 \text{ W}$	53	
7.	TCS	$M_{H} = 0.0175  (M_{PY}) + 45 = 56  \text{kg}$		26
		$P_{H} = 0.0438 \text{ (M}_{PY}) + 100 = 129 \text{ W (M}_{PY} < 2600)$	129	
· 8	Rendezvous & Docking	$M_{ m RD} = 0.1175~(M_{ m PY})~+~200 = 277~{ m kg}$		277
		$P_{RD} = 200 \text{ W}$	200	
		Sub Fot:	4,922	2,793
9.	Contingency & Integration	15% of the above power and mass	738	419
			Ь	M PL
ON N	NO. OF PLATFORMS: 95	TOTALS:	2,660	3,212

OTV: OTV, Reusable

OPER. MODE: C - Non-serviced, 16 year life

Platform Elements	Estimating Basis	Power, watts	Mass, kg
Payload Equipment	Item: 90 Case: III (Mpy < 3000)	4,040	762
Structure - Basic	$M_S = 0.31  (M_{PY}) + 50 = 286  kg$	0	728
- Secondary	$10\% \text{ of } M_S = 29 \text{ kg}$		
- T/W Penalty	$T/W = 0.0713 (P_O) + 240 = 413 kg$		
EPS	$M_{E} = 0.0713 (P_{O}) + 240 = 635 kg$		635
	$P_{E} = 0.067 (P_{O}) + 100 = 471 W$	471	
ACS	$M_A = 0.0294 (M_{PL}) + 64 = 219 kg$		219
	$P_A = 0.011  (M_{PL}) + 30 = 88  W$	88	
$RCS   M_{\mathbf{P}} = 0.332 (M_{\mathbf{PL}})$	$M_{R} = 1.2 (M_{P}) = 1.2 \times (1752) = 2102 \text{ kg}$		2,102
$M_{R} = M_{P} \rightarrow 0.2 M_{P}$	$P_{R} = 0.008  (M_{PY}) + 20 = 26  W$	26	
	$(M_{PY} < 4400)$		
TCC	$M_{T} = 0.0319 (M_{PY}) + 52 = 76 \text{ kg}$		76
	$P_{T} = 0.0195  (M_{PY}) + 40 = 55  W$	55	
TCS	$M_{H} = 0.0175 (M_{PY}) + 52 = 65 kg$		65
	$P_{H} = 0.0438  (M_{PY}) + 100 = 133  W$	133	
Rendezvous & Docking	N/A	N/A	N/A
	Sub Tot:	4,813	4,587
Contingency & Integration	15% of the above power and mass	722	688
O. OF PLATFORMS: 90	mom i	P 0	M <sub>PL</sub> 5,275
	Payload Equipment Structure - Basic - Secondary - T/W Penalty  EPS  ACS  RCS	Payload Equipment	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$

OPER. MODE: C' - Non-serviced, 16 yr life, consumables replenished at 8 yrs OTV: OTV, Reusable Power, Mass, Platform Elements **Estimating Basis** watts kg

	1.	Payload Equipment	Item: 91 Case: II (Mpy < 3000)	4,150	793
	2.	Structure - Basic	$M_S = 0.31 (M_{PY}) + 50 = 296 \text{ kg}$	0	472
		- Secondary	10% of M <sub>S</sub> = 30 kg		
		- T/W Penalty	T/W = 1.08; Penalty = 147 kg		
	3.	EPS	$M_{E} = 0.0609 (P_{O}) + 200 = 563 \text{ kg}$		563
			$P_{E} = 0.067 (P_{O}) + 100 = 500 W$	500	
	4.	ACS	$M_A = 0.0294 (M_{PL}) + 64 = 167 \text{ kg}$		167
G-96			$P_A = 0.011  (M_{PL}) + 30 = 69  W$	69	
6	5.	$M_{P} = 0.166 (M_{PL})$	$M_{R} = 1.2  (M_{P}) = 1.2 \times (583) = 700  \text{kg}$		700
		$M_{R} = M_{P} + 0.2 M_{P}$	$P_{R} = 0.008  (M_{PY}) + 20 = 26  W  (M_{PY} < 4400)$	26	
	6.	TCC R P	$M_{T} = 0.0319 (M_{PY}) + 52 = 77 \text{ kg}$		77
			$P_{T} = 0.0195  (M_{PY}) + 40 = 55  W$	55	
	7.	TCS	$M_{H} = 0.0175 (M_{PY}) + 52 = 66 \text{ kg}$		66
			$P_{H} = 0.0438  (M_{PY}) + 100 = 135  W$	135	
	8.	Rendezvous & Docking	$M_{RD} = 0.0193 \ (M_{PY}) + 200 = 215 \ kg$		215
			$P_{RD} = 200 W$	200	
			Sub Tot:	5,185	3,054
	9.	Contingency & Integration	15% of the above power and mass	778	458
				Po	$^{\mathrm{M}}_{\mathrm{PL}}$
	NO.	OF PLATFORMS: 87	TOTALS:		3,512

PLATFORM MASS & POWER ESTIMATES

OTV: OTV, L. T. Reusable

OPER. MODE: B - Non-serviced, 8 year life, replaced

PLATFORM NO. 79aB

2. 2.		Estimating Basis	watts	kg kg
2,	Payload Equipment	Item: 92 Case: II (M <sub>DV</sub> < 2200)	4,200	069
	Structure - Basic	$M_S = 0.396  (M_{PV}) + 50 = 323  \text{kg}$	0	356
	- Secondary	$10\%$ of $M_S = 32$ kg		
	- T/W Penalty	T/W = 0.13; Penalty = 0 kg		
ъ.	EPS	$M_E = 0.055 (P_o) + 187 = 500 \text{ kg}$		200
		$P_{E} = 0.067 (P_{o}) + 100 = 481 W$	481	
4.	ACS	$M_{A} = 0.0228 \; (M_{PL}) + 50 = 110 \; kg$		110
		$P_{A} = 0.011  (M_{PL}) + 30 = 59  W$	69	
5.	$RCS \qquad M_{\mathbf{p}} = 0.166$	$M_R = 1.2 \text{ (M}_P) = 1.2 \times (438) = 526 \text{ kg}$		526
	$M_{\mathbf{R}} = M_{\mathbf{P}} + 0.2 M_{\mathbf{P}}$	$P_{R} = 0.008 \; (M_{PY}) + 20 = 26 \; W$	26	
		$(M_{PY} < 4400)$		
9	TCC	${ m M_T}$ = 0.0306 ( ${ m M_{PY}}$ ) + 40 = 61 kg		61
		$P_{T} = 0.0195 \text{ (M}_{PY}) + 40 = 53 \text{ W}$	53	
7.	TCS	$M_{ m H} = 0.0175 \; (M_{ m PY}) + 40 = 52 \; { m kg}$		52
		$P_{H} = 0.0438 \; (M_{PY}) + 100 = 130 \; W$	130	
· •	Rendezvous & Docking	N/A	N/A	N/A
		Sub Tot:	4,949	2,295
9.	Contingency & Integration	15% of the above power and mass	742	344
NO	NO. OF PLATFORMS: 79	TOTA	P O TOTALS: 5,603	MPL

OTV: Centaur, L. T. Expendable

OPER, MODE: C - Non-serviced, 16 year life

	Platform Elements	Estimating Basis	Power, watts	Mass kg
1.	Payload Equipment	Item: 93 Case: II (Mpy < 3000)	4,250	942
2.	Structure - Basic	$M_S = 0.31  (M_{PY}) + 50 = 342  kg$	0	376
	- Secondary	$10\% \text{ of } M_S = 34 \text{ kg}$		
	- T/W Penalty	T/W = 0.19; Penalty = 0 kg		
3.	EPS	$M_E = 0.0713 (P_O) + 240 = 654 \text{ kg}$		654
		$P_{E} = 0.067 (P_{O}) + 100 = 489 W$	489	
1.	ACS	$M_A = 0.0294  (M_{PL}) + 64 = 210  \text{kg}$		210
		$P_A = 0.011 (M_{PL}) + 30 = 84 W$	84	
i.	$M_{\mathbf{p}} = 0.332  (M_{\mathbf{pL}})$	$M_R = 1.2  (M_p) = 1.2 \times (1645) = 1974  kg$		1,974
	$M_R = M_P + 0.2 M_P$	$P_{R} = 0.008  (M_{PY}) + 20 = 28  W$	28	
		$(M_{PY} < 4400)$		
j.	TCC	$M_T = 0.0319 (M_{PY}) + 52 = 82 kg$		82
		$P_{T} = 0.0195 \ (M_{PY}) + 40 = 58 \ W$	58	
	TCS	$M_{H} = 0.0175 (M_{PY}) + 52 = 68 \text{ kg}$		68
		$P_{H} = 0.0438  (M_{PY}) + 100 = 141  W$	141	
3.	Rendezvous & Docking	N/A	N/A	N/A
		Sub Tot:	5,051	4,306
	Contingency & Integration	15% of the above power and mass	758	646
			Po	$^{ m M}_{ m PL}$
10	O. OF PLATFORMS: 70	TOTA	LS: 5.808	4.952

OPER. MODE: C - Non-serviced, 16 year life OTV: IOTV, Expendable

	Platform Elements	Estimating Basis	Power, watts	Mass, kg
1.	Payload Equipment	Item: 94 Case: II (M <sub>PY</sub> < 3000)	4,250	942
2.	Structure - Basic	$M_S = 0.31 (M_{PY}) + 50 = 342 \text{ kg}$	0	824
	- Secondary	$10\% \text{ of M}_{S} = 34 \text{ kg}$		
	- T/W Penalty	T/W = 0.69; Penalty = 448 kg		
3.	EPS	$M_E = 0.0713 (P_O) + 240 = 672 \text{ kg}$		672
		$P_{E} = 0.067 (P_{O}) + 100 = 506 W$	506	
4.	ACS	$M_A = 0.0294 (M_{PL}) + 64 = 241 \text{ kg}$		241
		$P_A = 0.011 (M_{PL}) + 30 = 96 W$	96	
5.	$M_{p} = 0.332 (M_{pL})$	$M_R = 1.2 (M_P) = 1.2 \times (1995) = 2394 \text{ kg}$		2,394
	$M_{R} = M_{P} + 0.2 M_{P}$	$P_{R} = 0.008  (M_{PY}) + 20 = 28  W$	28	
	r P	$(M_{PY} < 4400)$		
6.	TCC	$M_{T} = 0.0319 (M_{PY}) + 52 = 82 kg$		82
		$P_{T} = 0.0195 (M_{PY}) + 40 = 58 W$	58	
7.	TCS	$M_{H} = 0.0175 (M_{PY}) + 52 = 68 \text{ kg}$		68
		$P_{H} = 0.0438  (M_{PY}) + 100 = 141  W$	141	
8.	Rendezvous & Docking	N/A	N/A	N/A
		Sub Tot:	5,274	5,224
9.	Contingency & Integration	15% of the above power and mass	791	784
			Po	$^{ m M}_{ m PL}$
NO	O. OF PLATFORMS: 70	TO	TALS: 6,066	6,608

PLATFORM MASS & POWER ESTIMATES

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PLATFORM NO. 81qE OPER. MODE: 3 yr consumables supply

1 2	201101110111		֡	
2	1. Pavload Remission	Estimating Basis	watts	kg kg
		ITEM: 95 Case: II ( $M_{\mathbf{PY}} < 2700$ )	4,285	878
		$M_S = 0.35 (M_{PY}) + 50 = 807 \text{ kg}$	0	1,035
	Yw bessite	10% of M <sub>S</sub> = 81 kg		
~	Sus	T/W = 1.08; Penalty = 147 kg		
2		$M_E = 0.0620 (P_O) + 210 = 587 \text{ kg}$		587
4	A CS	$P_{\rm E} = 0.067 \; (P_{\rm o}) + 100 = 507 \; W$	202	
		$M_A = 0.0258  (M_{PL}) + 56 = 156  \text{kg}$		156
5	RCS	$P_{A} = 0.011 (M_{PL}) + 30 = 73 W$	73	
		$M_R = 1.2 (M_p) = 1.2 \times (242) = 291 \text{ kg}$		291
9	$^{M}R = ^{M}P + 0.2 M_{P}$	$^{ m P}_{ m R}$ = 0.008 (M $_{ m PY}$ ) + 20 = 27 W (M $_{ m PY}$ < 4400)	27	1
		$M_{T} = 0.0317 \text{ (M}_{PY}) + 45 = 73 \text{ kg}$		73
7	800	$P_{T} = 0.0195 \; (M_{pY}) + 40 = 57 \; W$	57	į.
:		$M_{\rm H} = 0.0175~(M_{ m pY}) + 45 = 60~{ m kg}$		09
· ∞	Rendezvous & Docking	$_{\rm H}^{\rm P} = 0.0438 \; (\rm M_{\rm PY}) + 100 = 138 \; W \; (\rm M_{\rm PY} < 2600)$	138	}
		$^{M}_{RD} = 0.1175 (M_{PY}) + 200 = 303 \text{ kg}$		303
		$^{ m F_{RD}}$ = 200 W	200	
9.	Contingency & Integration	ot:	5,288 3	3,383
	e de la companya de l	13% of the above power and mass	793	208
NO	NO. OF PLATFORMS: 62			M <sub>P.L</sub>
		TOTALS: 6 082		2 001

OTV: 4 STG IUS (2L, 2L)

OPER. MODE: C - Non-serviced, 16 year life

	Platform Elements	Estimating Basis	Power, watts	Mass, kg
1.	Payload Equipment	Item: 96 Case: III (Mpy < 3000)	4,330	1,017
2.	Structure - Basic	$M_S = 0.31 (M_{PY}) + 50 = 365 \text{ kg}$	0	1,259
	- Secondary	10% of M <sub>S</sub> = 37 kg		
	- T/W Penalty	T/W = 1.93; Penalty = 857 kg		
3.	EPS	$M_{E} = 0.0713 (P_{O}) + 240 = 664 \text{ kg}$		664
		$P_{E} = 0.067 (P_{Q}) + 100 = 498 W$	498	
4.	ACS	$M_A = 0.0294 (M_{PL}) + 64 = 274 kg$		274
		$P_A = 0.011 (M_{PL}) + 30 = 109 W$	109	
5.	RCS $M_p = 0.332 (M_{PL})$	$M_R = 1.2 (M_p) = 1.2 \times (2374) = 2849 \text{ kg}$		2,849
	$M_{R} = M_{P} + 0.2 M_{P}$	$P_{R} = 0.008  (M_{PY}) + 20 = 28  W$	28	
		$(M_{PY} < 4400)$		
6.	TCC	$M_T = 0.0319 (M_{PY}) + 52 = 84 kg$		84
		$P_{T} = 0.0195 (M_{PY}) + 40 = 60 W$	60	
7.	TCS	$M_{H} = 0.0175 (M_{PY}) + 52 = 70 \text{ kg}$		70
		$P_{H} = 0.0438  (M_{PY}) + 100 = 145  W$	145	
8.	Rendezvous & Docking	N/A	N/A	N/A
		Sub Tot:	5,170	6,217
9.	Contingency & Integration	15% of the above power and mass	776	933
			Po	$^{ m M}_{ m PL}$
NO	. OF PLATFORMS: 58	TO'	TALS: 5,946	7,150

OTV: OTV, Reusable

PLATFORM NO. 83qB

OPER. MODE: B - Non-serviced, 8 year life replaced

	Platform Elements	Estimating Basis	Power, watts	Mass, kg
١.	Payload Equipment	Item: 97 Case: II (M <sub>PY</sub> < 2200)	4,700	860
	Structure - Basic	$M_S = 0.396  (M_{PY}) + 50 = 391  kg$	0	577
	- Secondary	10% of M <sub>S</sub> = 39 kg		
	- T/W Penalty	T/W = 1.08; Penalty = 147 kg		
	EPS	$M_E = 0.055 (P_O) + 187 = 536 kg$		536
		$P_{E} = 0.067 (P_{O}) + 100 = 525 W$	525	
	ACS	$M_A = 0.0228  (M_{PL}) + 50 = 126  kg$		126
		$P_A = 0.011 (M_{PL}) + 30 = 66 W$	0	
	RCS $M_p = 0.166 (M_{PL})$	$M_R = 1.2 (M_p) = 1.2 \times (550) = 660 \text{ kg}$		660
	$M_{R} = M_{P} + 0.2 M_{P}$	$P_{R} = 0.008  (M_{PY}) + 20 = 27  W$	27	
		$(M_{PY} < 4400)$		
	TCC	$M_T = 0.0306  (M_{PY}) + 40 = 66  kg$		66
		$P_{T} = 0.0195 (M_{PY}) + 40 = 57 W$	57	
	TCS	$M_{H} = 0.0175 (M_{PY}) + 40 = 55 \text{ kg}$		55
		$P_{H} = 0.0438 \ (M_{PY}) + 100 = 138 \ W$	138	
	Rendezvous & Docking	N/A	N/A	N/A
		Sub Tot:	5,512	2,879
	Contingency & Integration	15% of the above power and mass	827	432
10	. OF PLATFORMS: 52	TOTA	P o ALS: 6,339	M <sub>PL</sub> 3,311

PLATFORM NO. 84eC

			Power,	Mass,
-	Platform Elements	Estimating Basis	watts	kg
f. Pay	Payload Equipment	Item: 98 Case: II (Mpy < 3000)	4,740	1,120
	Structure - Basic	$M_S = 0.31  (M_{PY}) + 50 = 397  \text{kg}$	0	929
	- Secondary	$10\%$ of $M_S = 40 \text{ kg}$		
	- T/W Penalty	T/W = 0.64; Penalty = 492 kg		
3. EPS	S	$M_{\rm F} = 0.0713 \; (P_{\rm o}) + 240 = 701 \; \rm kg$		701
		$P_{E} = 0.067 (P_{O}) + 100 = 533 W$	533	
4. ACS	S	$M_A = 0.0294  (M_{PL}) + 64 = 262  \text{kg}$		262
		$P_A = 0.011  (M_{PL}) + 30 = 104  W$	104	
5. RCS	$M_{\rm p} = 0.332  (M_{\rm pr})$	$M_{D} = 1.2  (M_{D}) = 1.2 \times (2235) = 2682  \text{kg}$		2,682
	$M_{\rm R} = M_{\rm P} + 0.2 M_{\rm P}$	$P_{R} = 0.008 \text{ (M}_{PY}) + 20 = 29 \text{ W}$	29	
		$(M_{PY} < 4400)$		
6. TCC	C	$M_T = 0.0319  (M_{PV}) + 52 = 88  \text{kg}$		88
		$P_T = 0.0195  (M_{DV}) + 40 = 62  W$	62	
7. TCS	Si	$M_{H} = 0.0175  (M_{PV}) + 52 = 72  \text{kg}$		72
		$P_{H} = 0.0438 \text{ (M}_{PY}) + 100 = 149 \text{ W}$	149	
8. Re	Rendezvous & Docking	N/A	N/A	N/A
		Sub Tot:	5,617	5,852
6 Co	Contingency & Integration	15% of the above power and mass	843	878
	69		Po	MPL
NO ON	NO. OF PLATFORMS: 51	TOT	TOTALS: 6,459	6,730

PLATFORM MASS & POWER ESTIMATES

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PLATFORM NO. 85cC

	4		Power.	Mass
	Platform Elements	Estimating Basis	watts	kg
1.	Payload Equipment	Item: 99 Case: II (M <sub>PV</sub> < 3000)	4,780	1,130
2.	Structure – Basic	$M_S = 0.31  (M_{PV}) + 50 = 400  \text{kg}$	0	440
	- Secondary	$10\% \text{ of M}_{S} = 40 \text{ kg}$		
	- T/W Peneity	T/W = 0.08; Penalty = 0 kg		
3.	EPS	$M_E = 0.0713 (P_O) + 240 = 703 \text{ kg}$		703
		$P_{E} = 0.067 (P_{o}) + 100 = 535 W$	535	
4.	ACS	$M_A = 0.0294 \ (M_{PL}) + 64 = 230 \ kg$		230
		$P_A = 0.011  (M_{PL}) + 30 = 92  W$	92	
5.	RCS $M_{\rm p} = 0.332  (M_{\rm PL})$	$M_R = 1.2  (M_P) = 1.2 \times (1878) = 2254  kg$		2,254
	$M_{\mathbf{R}} = M_{\mathbf{P}} + 0.2 M_{\mathbf{P}}$	$P_{R} = 0.008 \; (M_{PY}) + 20 = 29 \; W$	29	
		$(M_{PV} < 4400)$		
6.	TCC	$M_T = 0.0319  (M_{PY}) + 52 = 88  \text{kg}$		88
		$P_{T} = 0.0195  (M_{PY}) + 40 = 62  \text{W}$	62	
7.	TCS	$M_{H} = 0.0175  (M_{PY}) + 52 = 72  \text{kg}$		72
		$P_{H} = 0.0438 \text{ (M}_{PY}) + 100 = 149 \text{ W}$	149	
တ	Rendezvous & Docking	N/A	N/A	N/A
		Sub Tot:	5,648	4,917
0	Contingency & Integration	15% of the above power and mass	847	738
CN	NO OF DIATEODMS. 60		P C	M <sub>Pr.</sub>
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4		Power, Mas	Power,	Mass,
	Distorm Floments	Estimating Basis	watts	kg
	Figure Equipment	Item: 100 Case: II (M <sub>DV</sub> < 3000)	4,960	1,161
	rayioau Equipment	= 0.31 (M) + 50	0	851
. 7	Structure - besic	Py Py		
	- Secondary	$10\% \text{ of M}_{S} = 41 \text{ kg}$		
	- T/W Penalty	T/W = 1.76; Penalty = 400 kg		
c.	S	$M_{\rm E} = 0.0609  (P_{\odot}) + 200 = 624  kg$		624
		$\frac{E}{P_{c}} = 0.067 \text{ (P )} + 100 = 566 \text{ W}$	929	
	20 V	$\frac{E}{M} = 0.0294 \text{ (M}_{2.}) + 64 = 206 \text{ kg}$		903
	200	A.	83	
u	( W) 991 0 = W SJa	4		.959
		$P_{\rm m} = 0.008 \; (M_{\rm p, c}) + 20 = 29 \; W \; (M_{\rm p, V} < 4400)$	29	
9	TCC	$M_{\text{m}} = 0.0319 \text{ (M}_{\text{m}}) + 52 = 89 \text{ kg}$		68
ó		$P_{\text{m}} = 0.0195 \text{ (M}_{\text{DV}}) + 40 = 63 \text{ W}$	63	
1	SG			72
		11	151	
0	Dandaguous E Dacking	$M_{\text{pos}} = 0.0193  (M_{\text{pos}}) + 200 = 222  \text{kg}$		222
0	delice avoids a coordinate		200	
		<b>2</b>	6,052	4,184
		159 of the above power and mass	806	829
9.	Contingency & Integration		Ь	$^{ m M}_{ m PL}$

PLATFORM MASS & POWER ESTIMATES

ON INCOMPANY	ODER MORE C' - Non-serviced, 16 yr life,	Oren. Mode: consumables replenished at 8 vrs	
The second secon	OTV: OTV, Reusable		

61pC'

	İ	Platform Elements	Estimating Basis	Power,	Mass, kg
	-	. Payload Equipment	Item: 101 Case: III (M <sub>2.1</sub> < 3000)	6.950	1 410
	2.	. Structure - Basic	M = 0.31  (M) + 50 = 400  M	0,0	1,419
		Space S	S S (MPY) + 30 = 450 Kg	0	952
		Secondary	$10\% \text{ of M}_{S} = 49 \text{ kg}$		
			T/W = 0.78; Penalty = 413 kg		
		EPS	$M_{ m E}$ = 0.0609 ( $P_{ m o}$ ) + 200 = 777 kg		777
			$P_{E} = 0.067 (P_{o}) + 100 = 735 W$	735	
G-	4.	ACS	$M_A = 0.0294 \ (M_{PL}) + 64 = 230 \ kg$		230
106			$P_A = 0.011  (M_{PL}) + 30 = 92  W$	92	
5	5.	RCS $M_{\rm p} = 0.166  (M_{\rm pL})$	$M_R = 1.2  (M_p) = 1.2 \times (936) = 1123  kg$	*	1.123
			$P_{R} = 0.008 \text{ (M}_{PY}) + 20 = 31 \text{ W (M}_{DV} < 4400)$	31	
	9.	TCC	$M_{\rm T} = 0.0319 \; (M_{\rm PV}) + 52 = 97 \; \text{kg}$		26
	t		$P_{T} = 0.0195  (M_{PY}) + 40 = 68  \text{W}$	89	5
	,	rcs	$M_{H} = 0.0175  (M_{PY}) + 52 = 77  \text{kg}$		77
		,	$P_{H} = 0.0438  (M_{PY}) + 100 = 162  W$	162	
	œ.	Rendezvous & Docking	$M_{ m RD}$ = 0.0193 ( $M_{ m PY}$ ) + 200 = 227 kg		227
			$P_{RD} = 200W$	200	
	o		Sub Tot:	8,238	4,902
		contingency & Integration	15% of the above power and mass	1,236	735
	NO.	NO. OF PLATFORMS: 33			M <sub>P.L.</sub>
		- 1	TOTALS: 9,473		5,637

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OTV: IOTV, Expendable

OPER. MODE: C - Non-serviced, 16 year life

PLATFORM NO.870C

			-	N
			rower,	Mass,
	Platform Elements	Estimating Basis	watts	kg
-:	Payload Equipment	Item: 102 Case: III (Mpy < 3000)	6,400	1,561
2.	Structure - Basic	$M_{S} = 0.31  (M_{PY}) + 50 = 534  \text{kg}$	0	1,199
	- Secondary	$10\%$ of $M_S = 53$ kg		
	- T/W Penalty	T/W = 0.51; Penalty = 612 kg		
3.	EPS	$M_{E} = 0.0713 \; (P_{O}) + 240 = 853 \; kg$		853
		$P_{\overline{F}} = 0.067 (P_{O}) + 100 = 676 W$	929	
4.	ACS	$M_A = 0.0294 \text{ (M}_{PL}) + 64 = 321 \text{ kg}$		321
		$P_A = 0.011 \text{ (M}_{PL}) + 30 = 126 \text{ W}$	126	
5.	RCS $M_p = 0.332  (M_{PL})$	$M_{R} = 1.2  (M_{p}) = 1.2 \times (2900) = 3480  \text{kg}$		3,480
	$M_{R} = M_{P} + 0.2 M_{P}$	$P_{R} = 0.008 \; (M_{PY}) + 20 = 32 \; W$	32	
		$(M_{PY} < 4400)$		
. 9	TCC	$M_T = 0.0319 \; (M_{PY}) + 52 = 102 \; kg$		102
		$P_{\rm T} = 0.0195 \; ({ m M_{ m PY}}) \; +  40 = 70 \; { m W}$	7.0	
7.	TCS	$M_{H} = 0.0175  (M_{PY}) + 52 = 79  \text{kg}$		6.2
		$P_{H} = 0.0438  (M_{PY}) + 100 = 168  W$	168	
8	Rendezvous & Docking	N/A	N/A	N/A
		Sub Tot:	7,473	7,594
9.	Contingency & Integration	15% of the above power and mass	1,121	1,139
2		EOE	P OTAIS: 0 504	M <sub>PL</sub>
Z	NO. OF PLAIFORMS: 30		6,034	6,134

	E - Serviced 16 OPER, MODE: 3 yr consumables
CATFORM MASS & POWER ESTIMATES	е
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$_{\rm PL}$	PLATFORM MASS & POWER ESTIMATES		PLATFORM NO. 87rE	4O. 87rE
0.1	OTV: Centaur, Expendable	OPER. MODE: 3 yr consumables supply	r life, supply	
			Power,	Мазв,
	Platform Elements	Estimating Basis	watts	kg
1.	Payload Equipment	Item: 103 Case II ( $M_{ m PY}$ < 2700)	6,400	1,361
2.	Structure - Basic	$M_S = 0.35  (M_{PY}) + 50 = 976  \text{kg}$	0	1,474
	- Secondary	$108 \text{ of M}_{S} = 98 \text{ kg}$		
	<ul><li>T/W Penalty</li></ul>	T/W = 1.76; Penalty = 400 kg		
3.	EPS	$M_{ m E}$ = 0.0620 ( $P_{ m o}$ ) + 210 = 754 kg		754
		$P_{E} = 0.067 \; (P_{O}) + 100 = 688 \; W$	889	
4.	ACS	$M_A = 0.0258  (M_{PL}) + 56 = 196  \text{kg}$		196
		$P_{A} = 0.011 \text{ (M}_{PL}) + 30 = 90 \text{ W}$	06	
ů.	RCS $M_{\mathbf{p}} = 0.0623  (M_{\mathbf{pL}})$	$M_R = 1.2 \ (M_P) = 1.2 \times (337) = 405 \ kg$		405
	$M_{\mathbf{R}} = M_{\mathbf{P}} + 0.2 M_{\mathbf{P}}$	$P_{ m R} = 0.008 \; (M_{ m PY}) + 20 = 31 \; W \; (M_{ m PY} < 4400)$	31	
9.	TCC	$M_{T} = 0.0317 \; (M_{PY}) + 45 = 88 \; kg$		88
		$P_{T} = 0.0195 \; (M_{PY}) + 40 = 67 \; W$	29	
7.	TCS	$M_H = 0.0175  (M_{PY}) + 45 = 69  \text{kg}$	٠	69
		$P_{\mathrm{H}}$ = 0.0438 ( $M_{\mathrm{PY}}$ ) + 100 = 160 W ( $M_{\mathrm{PY}}$ < 2600)	160	
8	Rendezvous & Docking	$M_{ m RD}$ = 0.1175 ( $M_{ m PY}$ ) + 200 = 360 kg		360
		$P_{RD} = 200 \text{ W}$	200	
		Sub Tot:	7,635	4,707
9.	Contingency & Integration	15% of the above power and mass	1,145	902
NO	NO. OF PLATFORMS: 30	TOTALS	Po 8.780	$^{ m M_{PL}}_{ m 5.413}$

PL. OT	PLATFORM MASS & POWER ESTIMATES OTV: IOTV, Expendable	DLATFORM NO. 88fC' C' - Non-serviced, 16 yr life, OPER. MODE: consumables replenished at 8 yrs	PLATFORM 16 yr life, ished at 8 y	NO. 88fC'
	Platform Elements	Estimating Basis	Power, watts	Mass, kg
1.	Payload Equipment	Item: 104 Case: II (M <sub>PY</sub> < 3000)	6,470	1,600
	Structure – Basic – Secondary	$M_S = 0.31 (M_{PY}) + 50 = 546 \text{ kg}$ 10% of $M_S = 55 \text{ kg}$	0	1,049
	- I/W Penalty	T/W = 0.69; Penalty = 448 kg		
3.	EPS	$M_E = 0.0609 (P_O) + 200 = 742 \text{ kg}$		742
		$P_{\rm E} = 0.067 \; (P_{\rm O}) + 100 = 696 \; W$	969	
4.	ACS	- ✓	90	241
5.	RCS $M_{\rm p} = 0.166  (M_{\rm PL})$	$F_{ m A} = 0.011~({ m M_{PL}})^{-1} + 30^{-1} = 30~{ m W}$ ${ m M_{ m R}} = 1.2~({ m M_{ m P}})^{-1} = 1.2  imes (1002)^{-1} = 1203~{ m kg}$	S	1,203
	$M_{R} = M_{P} + 0.2 M_{P}$	$P_{R} = 0.008 \; (M_{PY}) + 20 = 33 \; W \; (M_{PY} < 4400)$	33	
6.	TCC		ē	103
7.	TCC	$ m P_T = 0.0195 \; (M_{PY}) + 40 = 71 \; W$ $ m M_H = 0.0175 \; (M_{PY}) + 52 = 80 \; kg$	11	80
		$P_{H} = 0.0438 \; (M_{PY}) + 100 = 170 \; W$	170	
·	Rendezvous & Docking	$M_{ m RD}$ = 0.0193 ( $M_{ m PY}$ ) + 200 = 231 kg		231
		$P_{RD} = 200 \text{ W}$	200	
		Sub Tot:	7,736	5,249
9.	Contingency & Integration	15% of the above power and mass	1,160 P	787 M
NO	NO. OF PLATFORMS: 29	TOTALS:	8,897	6,036

L	PLATFORM MASS & POWER EDITION IN		vear life. re	8 year life, replaced
5	Centaur, Expendable	OPER, MODE: B - Non-serviced, o year	1000	
7.	01V:		Power,	Mass,
		Estimating Basis	watts	Kg
	Platform Elements	Item: 105 Case: II (Mpy < 2200)	6,620	1,280
		$M_S = 0.396  (M_{PY}) + 50 = 557  \text{kg}$	0	1,013
	Ţ	$108 \text{ of M}_{\text{S}} = 56 \text{ kg}$		
	- T/W Penalty	T/W = 1.76; Penalty = 400 kg		078
~	SOCI	$M_{\rm H} = 0.055 \; (P_{\rm O}) + 187 = 670 \; {\rm kg}$		
		$P_{\rm H} = 0.067 \; (P_{\rm O}) + 100 = 689 \; \text{W}$	689	
4	ACS	$M_A = 0.0228 \text{ (M}_{PL}) + 50 = 161 \text{ kg}$	0	101
		$P_A = 0.011  (M_{PL}) + 30 = 84  W$	84	
	000	$M_{\odot} = 1.2  (M_{\rm p}) = 1.2 \times (809) = 970  \text{kg}$		1.6
	M = M +	$P_{D} = 0.008 \text{ (M}_{PV}) + 20 = 30 \text{ W (M}_{PY} < 4400)$	30	
	R P	$M_{\odot} = 0.0306  (M_{D_{\odot}}) + 40 = 79  \text{kg}$		
9	. rcc	$T_{\rm r}$ = 0.0195 ( $M_{\rm PV}$ ) + 40 = 65 W	65	
ţ		$M_{\odot} = 0.0175  (M_{D,V}) + 40 = 62  \text{kg}$		
	. Ics	$P = 0.0438  (M_{\odot,y}) + 100 = 156  W$	156	
		Y4 H	N/A	N/A
œ	i. Rendezvous & Docking	Sub Tot:	7,644	4,23
6	9. Contingency & Integration	15% of the above power and mass	1,147	
			o d	$M_{PL}$
		TOTALS:	8 790	4.8

G-110

M<sub>PL</sub> 4,871

N/A 4,236

43

970

161

670

1,280 1,013

Mass, kg 62

635

TES
ESTIMATES
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P1	PLATFORM MASS & POWER ESTIMATES OTV: Centaur, L. T. Expendable	TES PLATFORM NO  E - Serviced, 16 yr life,  OPER. MODE: 3 yr consumables supply	LATFORM NO. life,	62bE
	Platform Elements	Estimating Basis	Power, watts	Mass, kg
1.	Payload Equipment	Item: 106 Case II (M <sub>PV</sub> < 2700)	6,690	1, 485
2.	Structure - Basic	$M_S = 0.35  (M_{PV}) + 50 = 570  \text{kg}$	0	627
	- Secondary	$108 \text{ of M}_{S} = 57 \text{ kg}$		
	<ul><li>T/W Penalty</li></ul>	T/W = 0.19; Penalty = 0 kg		
3.	EPS	$M_E = 0.0620 (P_o) + 210 = 777 \text{ kg}$		777
		$P_{E} = 0.067 (P_{O}) + 100 = 712 W$	712	
4	ACS	$M_A = 0.0258  (M_{PL}) + 56 = 173  kg$		173
		$P_A = 0.011  (M_{PL}) + 30 = 80  W$	80	
5.	RCS	$M_R = 1.2 (M_P) = 1.2 \times (282) = 338 \text{ kg}$		338
	$M_{\mathbf{R}} = M_{\mathbf{P}} + 0.2 M_{\mathbf{P}}$	$P_{R} = 0.008 \text{ (M}_{PY}) + 20 = 32 \text{ W (M}_{PY} < 4400)$	32	
9.	TCC	$M_{T} = 0.0317 \; (M_{PY}) + 45 = 92 \; kg$		92
		$P_{T} = 0.0195 \; (M_{PY}) + 40 = 69 \; W$	69	
7.	TCS	$M_{H} = 0.0175  (M_{PY}) + 45 = 71  \text{kg}$		7.1
		$P_{ m H} = 0.0438~(M_{ m PY})$ + 100 = 165 W ( $M_{ m PY}$ < 2600)	165	
8	Rendezvous & Docking	$M_{ m RD}$ = 0.1175 ( $M_{ m PY}$ ) + 200 = 374 kg		374
		$P_{RD} = 200 \text{ W}$	200	
		Sub Tot:	7,947	3,937
9.	Contingency & Integration	15% of the above power and mass	1,192	591
NO	NO. OF PLATFORMS: 26	TOTALS:	P o 9,139	M <sub>PL</sub> 4,527

PL	PLATFORM MASS & POWER ESTIMATES	FES E - Serviced, 16 yr life,	TFORM NO.	90pE
OT	OTV: OTV, Reusable		X	
			Power,	Mass,
	Platform Elements	Estimating Basis	watts	kg
-	Pavload Equipment	Item: 107 Case: III (M <sub>DV</sub> < 2700)	066,9	1,530
2.	Structure - Basic	$M_{S} = 0.35  (M_{PY}) + 50 = 1036  \text{kg}$	0	1,552
	- Secondary	$10\% \text{ of M}_{\text{S}} = 104 \text{ kg}$		
	- T/W Penalty	T/W = 0.78; Penalty = 413 kg		
3.	EPS	$M_{K} = 0.0620 \; (P_{O}) + 210 = 801 \; kg$		801
		$P_{\rm E} = 0.067 \; (P_{\rm O}) + 100 = 739 \; \text{W}$	739	
4	ACS	$M_{A} = 0.0258 \text{ (M}_{PL}) + 56 = 206 \text{ kg}$		206
		$P_A = 0.011  (M_{PL}) + 30 = 94  W$	94	
5.	RCS $M_{\rm S} = 0.0623  (M_{\rm BJ})$			436
	$M_{\rm B} = M_{\rm B} + 0.2$	$P_{B} = 0.008 \text{ (M}_{PY}) + 20 = 32 \text{ W (M}_{PY} < 4400)$	32	
9	<u>.</u>			94
		$P_T = 0.0195  (M_{PV}) + 40 = 70  W$	0.2	
7	TCS	$M_{LI} = 0.0175  (M_{DV}) + 45 = 72  \text{kg}$		7.2
,		$P_{13} = 0.0438 \; (M_{D,Y}) + 100 = 167 \; W \; (M_{P,Y} < 2600)$	167	
ж	Rendezvous & Docking	$M_{BD} = 0.1175  (M_{PY}) + 200 = 380  \text{kg}$		380
		$P_{\rm BLS} = 200 \text{ W}$	200	
		KD Sub Tot:	8,292	5,071
0	Contingency & Integration	15% of the above power and mass	1,244	761
e.	centiligency a michael		<b>م</b> د	$M_{PL}$
2	NO OF PLATFORMS: 25	TOTALS:	9,536	5,831
4				

ESTIMATES
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MASS
PLATFORM

PLATFORM NO. 90bB	OPER. MODE: B - Non-serviced, 8 year life, replaced
PLATFORM MASS & POWER ESTIMATES	OTV: Centaur, L. T. Expendable 0

			Fower,	Mass,
	Platform Elements	Estimating Basis	watts	kg
Ξ.	Payload Equipment	Item: 108 Case: II (Mpv < 2200)	6,990	1,400
2.	Structure - Basic	$M_S = 0.396  (M_{PX}) + 50 = 604  kg$	0	999
	- Secondary	$10\% \text{ of M}_{S} = 60 \text{ kg}$		
	- T/W Penalty	T/W = 0.19; Penalty = 6 kg		
3.	EPS	$M_{E} = 0.055 (P_{o}) + 187 = 696 \text{ kg}$		969
		$P_{E} = 0.067 (P_{O}) + 100 = 720 W$	720	
4.	ACS	$M_A = 0.0228 \ (M_{PL}) + 50 = 154 \ kg$		154
		$P_A = 0.011  (M_{PL}) + 30 = 80  \text{W}$	80	
5.	RCS $M_{p} = 0.166  (M_{pL})$	$M_{\rm B} = 1.2 \; (M_{\rm p}) = 1.2 \times (758) = 910 \; {\rm kg}$		910
	$M_{R} = M_{P} + 0.2 M_{P}$	$P_{\rm R} = 0.008  (M_{\rm DV}) + 20 = 31  \text{W}  (M_{\rm DV} < 4400)$	31	
9.	TCC	$M_{T} = 0.0306  (M_{PY}) + 40 = 83  \text{kg}$		83
		$P_T = 0.0195  (M_{PV}) + 40 = 67  W$	29	
7.	TCS	$M_H = 0.0175  (M_{PY}) + 40 = 65  \text{kg}$		65
		$P_{H} = 0.0438  (M_{PY}) + 100 = 161  W$	161	
8	Rendezvous & Docking	N/A	N/A	N/A
		Sub Tot:	8,051	3,972
6	Contingency & Integration	15% of the above power and mass	1,208	596
			а.	M
20	NO. OF PLATFORMS: 25	TOTALS:	9.258	4.568

OTV: OTV, Reusable

OPER. MODE: B - Non-serviced, 8 year life, replaced

_	Platform Elements	Estimating Basis	Power, watts	Mass, kg
1:	Payload Equipment	Item: 109 Case III (Mpy < 2200)	7,290	1,420
2.	Structure - Basic	$M_S = 0.396  (M_{PY}) + 50 = 612  kg$	0	1,087
	- Secondary	10% of M <sub>S</sub> = 61 kg		
	- T/W Penalty	T/W = 0.78; Penalty = 413 kg		
3.	EPS	$M_{E} = 0.055 (P_{O}) + 187 = 717 \text{ kg}$		717
		$P_{E} = 0.067 (P_{O}) + 100 = 746 W$	746	
4.	ACS	$M_A = 0.0228  (M_{PL}) + 50 = 171  kg$		171
		$P_A = 0.011  (M_{PL}) + 30 = 88  W$	88	
5.	RCS $M_p = 0.166 (M_{PL})$	$M_{R} = 1.2  (M_{P}) = 1.2 \times (877) = 1053  kg$		1,053
	$M_{R} = M_{P} + 0.2 M_{P}$	$P_{R} = 0.008  (M_{PY}) + 20 = 31  W  (M_{PY} < 4400)$	31	
6.	TCC	$M_{T} = 0.0306 \ (M_{PY}) + 40 = 83 \ kg$		83
		$P_{T} = 0.0195 \ (M_{PY}) + 40 = 68 \ W$	68	
7.	TCS	$M_{H} = 0.0175  (M_{PY}) + 40 = 65  kg$		65
		$P_{H} = 0.0438  (M_{PY}) + 100 = 162  W$	162	
8.	Rendezvous & Docking	N/A	N/A	N/A
		Sub Tot:	8,385	4,596
9.	Contingency & Integration	15% of the above power and mass	1,258	689
			Po	MPL
NO	O. OF PLATFORMS: 24	TOTALS:	9,645	5,285

PLA

PLATFORM NO. 91eC'	OPER. MODE: consumables replenished at 8 yrs	
	OPE	
LATFORM MASS & POWER ESTIMATES	TV: OTV, Expendable	

1. 2.				
1.	Platform Elements	Estimating Basis	Power, watts	Mass,
2.	Payload Equipment	Item: 110 Case: II (M <sub>D.V.</sub> < 3000)	7,290	1.858
	Structure - Basic	$M_S = 0.31  (M_{P,Y}) + 50 = 626  \text{kg}$	0	1,181
	- Secondary	$10\%$ of $M_S = 63 \text{ kg}$		
	- T/W Penalty	T/W = 0.64; Penalty = 492 kg		
3.	EPS	$M_E = 0.0609 (P_o) + 200 = 806 kg$		908
		$P_{E} = 0.067 (P_{o}) + 100 = 767 W$	767	
4.	ACS	$M_A = 0.0294 \ (M_{PL}) + 64 = 263 \ kg$		263
-11		$P_A = 0.011  (M_{PL}) + 30 = 104  W$	104	
5.	RCS $M_{P} = 0.166 (M_{PL})$	$M_R = 1.2 (M_p) = 1.2 \times (1124) = 1349 \text{ kg}$		1,349
	$M_{\mathbf{R}} = M_{\mathbf{P}} + 0.2 M_{\mathbf{P}}$	$P_{R} = 0.008 \; (M_{PY}) + 20 = 35 \; W \; (M_{PY} < 4400)$	35	
6.	TCC	$M_T = 0.0319  (M_{PY}) + 52 = 111  \text{kg}$		111
		$P_{T} = 0.0195 \; (M_{PY}) + 40 = 76 \; W$	92	
7.	TCS	$M_{H} = 0.0175  (M_{PY}) + 52 = 85  \text{kg}$		85
		$P_{H} = 0.0438  (M_{PY}) + 100 = 181  W$	181	
∞ <b>.</b>	Rendezvous & Docking	$M_{RD} = 0.0193  (M_{PX}) + 200 = 236  kg$		236
		$P_{RD} = 200 \text{ W}$	200	
		Sub Tot:	8,653	5,888
9.	Contingency & Integration	15% of the above power and mass	1,298	883
			ч°	$^{ m M_{PL}}$
ON	NO. OF PLATFORMS: 24	TOTALS:	9,951	6,771

PLATFORM MASS & POWER ESTIMATES

OTV: 4 STG IUS, (2L, 2L)

OPER. MODE: Consumables replenished at 8 yrs

	Platform Elements	Estimating Basis	Power,	Mass,
1.	Payload Equipment	Item: 111 Case: III (M < 3000)	Walls	X S
2	Structure - Basic	M = 0 31 (M ) = 60 - 60 - 60 - 60 - 60 - 60 - 60 - 60	0000,	1,896
		$^{11}S = 0.31 \text{ (M}_{PY}) + 30 = 638 \text{ kg}$	0	1,559
	- Secondary	$10\% \text{ of M}_{S} = 64 \text{ kg}$		
	· · T/W Penalty	T/W = 1.93; Penalty = 857 kg		
3,	EPS	$M_E = 0.0609 (P_O) + 200 = 830 \text{ kg}$		830
		$P_{E} = 0.067 (P_{o}) + 100 = 793 W$	793	
4.	ACS	$M_A = 0.0294  (M_{PL}) + 64 = 283  \text{kg}$		283
		$P_A = 0.011  (M_{PL}) + 30 = 112  W$	112	
5.	$RCS \qquad M_{\mathbf{P}} = 0.166  (M_{\mathbf{PL}})$	$M_{\rm R} = 1.2  (M_{\rm p}) = 1.2  \times (1239) = 1487  \rm kg$		1 487
,	$M_{R} = M_{P} + 0.2 M_{P}$	$P_{R} = 0.008 \text{ (M}_{PY}) + 20 = 35 \text{ W (M}_{PV} < 4400)$	35	
. 9	TCC	$M_{\rm T} = 0.0319 \; (M_{\rm PY}) + 52 = 112 \; {\rm kg}$		112
		$P_{\rm T} = 0.0195 \; (M_{\rm PX}) + 40 = 77 \; \text{W}$	77	
7.	TCS	$M_H = 0.0175  (M_{PY}) + 52 = 85  \text{kg}$		85
		$P_{H} = 0.0438 \; (M_{PY}) + 100 = 183 \; W$	183	
œ œ	Rendezvous & Docking	$M_{RD}$ = 0.0193 ( $M_{PY}$ ) + 200 = 237 kg		237
		$P_{RD} = 200 \text{ W}$	200	
-		Sub Tot:	9,001	6,490
,	Contingency & Integration	15% of the above power and mass	1,350	973
ζο.	NO. OF PLATFORMS: 23		ч o	$M_{\rm PL}$
		TOTALS:	10,351	7.463

PLATFORM NO. 93gC

_	Platform Elements	Estimating Basis	Power, watts	Mass, kg
ł.	Payload Equipment	Item: 112 Case: III (Mpy < 3000)	7,900	1,954
2.	Structure - Basic	$M_S = 0.31  (M_{PY}) + 50 = 656  kg$	0	721
	- Secondary	10% of M <sub>S</sub> = 66 kg		
	- T/W Penalty	T/W = 0.06; Penalty = 0 kg		
3.	EPS	$M_E = 0.0713 (P_Q) + 240 = 989 kg$		989
		$P_E = 0.067 (P_O) + 100 = 803 W$	803	
4.	ACS	$M_{\Lambda} = 0.0294  (M_{PL}) + 64 = 326  \text{kg}$	×	326
		$P_{\Delta} = 0.011 \ (M_{PL}) + 30 = 128 \ W$	128	
5.	RCS $M_p = 0.332 (M_{PL})$	$M_R = 1.2 (M_p) = 1.2 \times (2954) = 3544 \text{ kg}$		3,544
	$M_{\mathbf{p}} = M_{\mathbf{p}} + 0.2 M_{\mathbf{p}}$	$P_{R} = 0.008  (M_{PY}) + 20 = 36  W  (M_{PY} < 4400)$	36	
6.	K I I	$M_T = 0.0319 (M_{PY}) + 52 = 114 \text{ kg}$		114
		$P_{T} = 0.0195  (M_{PY}) + 40 = 78  W$	78	
7.	TCS	$M_H = 0.0175 (M_{PV}) + 52 = 86 \text{ kg}$		86
		$P_{H} = 0.0438  (M_{PY}) + 100 = 186  W$	186	
8.	Rendezvous & Docking	N/A	N/A_	N/A
		Sub Tot:	9,130	7,735
9.	Contingency & Integration	15% of the above power and mass	1,370	1,160
			Po	$^{\mathrm{M}}_{\mathrm{PL}}$
NO	O. OF PLATFORMS: 22	TOTALS:	10,500	8,895

PLATFORM N	OPER. MODE: C - Non-serviced, 16 year life	Power,
ESTIMATES	OPER. MO	
PLATFORM MASS & POWER ESTIMATES	OTV: OTV, Expendable	

PLATFORM NO. 63nC

	Platform Elements	Estimating Basis	Power, watts	wass, kg
	Fayload Equipment	Item: 113 Case: III ( $M_{ m pY}$ < 3000)	8,500	2,051
2.	Structure - Basic	$M_S = 0.31  (M_{PY}) + 50 = 686  \text{kg}$	0	1,471
	- Secondary	$10\% \text{ of M}_{S} = 69 \text{ kg}$		
	- T/W Penalty	T/W = 0.43; Penalty = 716 kg		
	EPS	$M_{\overline{E}} = 0.0713 \; (P_{_{O}}) + 240 = 1045 \; kg$		1,045
		$P_{\rm E} = 0.067 \; (P_{_{\rm O}}) + 100 = 856 \; W$	856	
4.	ACS	$M_A = 0.0294  (M_{PL}) + 64 = 386  \text{kg}$		386
		$P_A = 0.011 \text{ (M}_{PL}) + 30 = 150 \text{ W}$	150	
5.	RCS $M_{\rm p} = 0.332  (M_{\rm pL})$	$M_{R} = 1.2 \text{ (M}_{p}) = 1.2 \times (3635) = 4362 \text{ kg}$		4,362
	$M_{\mathbf{B}} = M_{\mathbf{P}} + 0.2 M_{\mathbf{P}}$	$P_{\rm H} = 0.008  (M_{\rm PT}) + 20 = 36  \text{W}  (M_{\rm PY} < 4400)$	36	
9	TCC	$M_T = 0.0319  (M_{PY}) + 52 = 117  \text{kg}$		117
		$P_{T} = 0.0195 \text{ (M}_{PY}) + 40 = 80 \text{ W}$	80	
7.	TCS	$M_{H} = 0.0175  (M_{PY}) + 52 = 88  \text{kg}$		88
		$\tilde{p}_{H} = 0.0438 \text{ (M}_{PY}) + 100 = 190 \text{ W}$	190	
œ.	Rendezvous & Docking	N/A	N/A	N/A
		Sub Tot:	9,812	9,519
9.	Contingency & Integration	15% of the above power and mass	1,472	1,428
			d	M
ž	NO OF STATEORMS: 30	TOTATS:	0	PL.

PLATFORM MASS & POWER ESTIMATES

OTV: IOTV, L. T. Expendable	OTV: IOTV, L. T. Expendable	OPER. MODE: 3 consumables supply	r life,	
	Platform Elements	Estimating Basis	Power,	Mass, kg
-:	Payload Equipment	Item: 114 Case: II (M <sub>p.v</sub> < 2700)	8,500	1,822
2.	Structure - Basic	$M_S = 0.35  (M_{PY}) + 50 = 688  \text{kg}$	0	756
	- Secondary	$10\% \text{ of M}_{S} = 69 \text{ kg}$		
	- T/W Penalty	T/W = 0.08; Penalty = 0 kg		
	EPS	$M_{ m E} = 0.0620 \; (P_{ m o}) + 210 = 919 \; { m kg}$		919
		$P_{E} = 0.067 (P_{o}) + 100 = 866 W$	998	
4.	ACS	11		195
		11	68	
5,	RCS $M_{\mathrm{p}} = 0.0623  (M_{\mathrm{pL}})$	$M_{R} = 1.2 \text{ (M}_{p}) = 1.2 \times (336) = 403 \text{ kg}$		403
	$M_{R} = M_{P} + 0.2 M_{P}$	$P_{\rm R} = 0.008 \; (M_{\rm PY}) + 20 = 35 \; W \; (M_{\rm PV} < 4400)$	35	
9	TCC			103
		11	91	
7.	TCS	$M_H = 0.0175  (M_{PY}) + 45 = 77  \text{kg}$		77
		11.	180	
ż	Rendezvous & Docking	Q		414
		$P_{RD} = 200 \text{ W}$	200	
		Sub Tot:	9,946	4,689
9.	Contingency & Integration	15% of the above power and mass	1,492	133
ON	NO. OF PLATFORMS: 20	TOTALE.	P O 11 437	M <sub>PL</sub>

OTV:				å
			Power,	Mass,
	Distform Flaments	Estimating Basis	watts	kg
-	Pigitorii Eigineires	Item: 115 Case: II (M <sub>D</sub> C < 2700)	8,500	1,822
	Structure - Basic	$M_{\odot} = 0.35  (M_{\Sigma N}) + 50 = 1138  \text{kg}$	0	1,699
	- Secondary	$16\% \text{ of M}_{c} = 114 \text{ kg}$		
	T/W Penalty	T/W = 0.69; Penalty = 448 kg		
~	Sda	$M_{\odot} = 0.0620 \text{ (P_{\odot})} + 210 = 920 \text{ kg}$		920
		$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}$	867	
4		$M_{\rm c} = 0.0258 \; (M_{\rm D, I}) + 56 = 227 \; \text{kg}$		227
ř		$P_{\star} = 0.011 \text{ (M}_{DT}) + 30 = 103 \text{ W}$	103	
ď	$M_{\odot} = 0.0623  (M_{\odot})$	$M_{\rm D} = 1.2  (M_{\rm D}) = 1.2 \times (413) = 495  \text{kg}$	4	495
		$P_{D} = 0.008 \text{ (M}_{DV}) + 20 = 35 \text{ W (M}_{PY} < 4400)$	35	
9	7 F. 7.			103
;		11	91	
1	TCS	$M_{LI} = 0.0175  (M_{DV}) + 45 = 77  \text{kg}$		77
:		$P_{LL} = 0.0438 \text{ (M}_{D_{L}}) + 100 = 180 \text{ W (M}_{D_{L}} < 2600)$	180	
œ	Rendezvous & Docking	$M_{DS} = 0.1175  (M_{DV}) + 200 = 414  \text{kg}$		414
,		$P_{\text{max}} = 200 \text{ W}$	200	
		RD Sub Tot:	9,960	5,757
O	Contingency & Integration	15% of the above power and mass	1,494	864
			Ро	$M_{ m PL}$
		SA THOM	, , ,	.00

PLATFORM MASS & POWER ESTIMATES OTV: IOTV, L. T. Expendable

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life
8 year
Non-serviced,
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MODE:
OPER.

	Platform Elements	Estimating Basis	watts	kg
-	Payload Equipment	Item: 116 Case: II (Mpv < 2200)	8,500	1,620
2.	Structure - Basic	$M_S = 0.396  (M_{PY}) + 50 = 692  \text{kg}$	0	761
	- Secondary	$108 \text{ of M}_{\text{S}} = 69 \text{ kg}$		
	- T/W Penalty	T/W = 6.08; Penalty = 0 kg		
	EPS	$M_{\rm F} = 0.55 \; (P_{_{\rm O}}) + 187 = 801 \; {\rm kg}$		801
		$P_{E} = 0.067 (P_{O}) + 100 = 848 W$	848	
4.	ACS	$M_{\star} = 0.0228  (M_{DI}) + 50 = 169  \text{kg}$		169
		$P_A = 0.011  (M_{DI}) + 30 = 88  W$	88	
5.	RCS $M_{\rm S} = 0.166  (M_{\rm NJ})$	$M_{D} = 1.2  (M_{D}) = 1.2 \times (869) = 1043  \text{kg}$		1,043
	$M_{D} = M_{D} + 0.2 M_{D}$	$P_{R} = 0.008 \text{ (M}_{PY}) + 20 = 33 \text{ W (M}_{PY} < 4400)$	33	
9	TCC	$M_{TC} = 0.0306  (M_{DC}) + 40 = 90  \text{kg}$		06
		$P_T = 0.0195  (M_{PY}) + 40 = 72  W$	7.2	
7.	TCS	$M_{H} = 0.0175  (M_{PV}) + 40 = 68  \text{kg}$		89
		$P_{H} = 0.0438  (M_{PV}) + 100 = 171  W$	171	
8	Rendezvous & Docking	N/N	N/A	N/A
		Sub Tot:	9,712	4,553
9.	Contingency & Integration	15% of the above power and mass	1,457	683
			Ь	$M_{\mathrm{PL}}$
2		TOTALS	11.169	5.236

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LATFORM MASS & POWER ESTIMATES	
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PLATFORM NO. 101fB

OI	OTV: IOTV, Expendable	OPER, MODE: B - Non-serviced, 8 year life, replaced	8 year life,	replaced
	Platform Elements	Estimating Basis	Power,	Mass, kg
1.	Payload Equipment	Item: 117 Case: II (Mpy < 2200)	9,235	1,760
2.	Structure - Basic	$M_S = 0.396  (M_{P,Y}) + 50 = 747  kg$	0	1,270
	- Secondary	$108 \text{ of M}_{S} = 75 \text{ kg}$		
	- T/W Penalty	T/W = 0.69; Penalty = 448 kg		
3.	EPS	$M_{\rm E} = 0.055  (P_{_{\rm O}}) + 187 = 853  {\rm kg}$		853
		$P_E = 0.067 (P_O) + 100 = 911 W$	911	
4.	ACS	$M_A = 0.0228  (M_{PL}) + 50 = 194  \text{kg}$		194
		$P_A = 0.011  (M_{PL}) + 30 = 100  W$	100	
5.	RCS $M_{p} = 0.166  (M_{PL})$	$M_{\rm R} = 1.2  (M_{\rm p}) = 1.2 \times (1050) = 1260  \text{kg}$		1,260
	$M_{B} = M_{P} + 0.2 M_{P}$	$P_{R} = 0.008 \; (M_{PY}) + 20 = 34 \; W \; (M_{PY} < 4400)$	34	
9.	TCC	$M_T = 0.0306  (M_{PY}) + 40 = 94  \text{kg}$		94
		$P_T = 0.0195  (M_{PY}) + 40 = 74  W$	7.4	
7.	TCS	$M_H = 0.0175  (M_{PY}) + 40 = 71  \text{kg}$		7.1
		$P_{H} = 0.0438  (M_{PY}) + 100 = 177  W$	177	
∞	Rendezvous & Docking	N/A	N/A	N/A
		Sub Tot:	10,531	5,503
9.	Contingency & Integration	15% of the above power and mass	1,580	825
				11
			d o	$^{ m MPL}$
ž	NO. OF PLATFORMS: 20	TOTALS:	12,111	6,327

NO. OF PLATFORMS: 20

Ь	PLATFORM MASS & POWER ESTIMATES		PLATFORM NO. 94hC	94hC
0	OTV: OTV, L. T. Expendable	OPER. MODE: C - Non-serviced, 16 year life	16 year life	
l	Dlatform Flamente	Patimating Basis	Power,	Mass,
1	Tation Elements	Cross Surramen	44113	9.1
Τ.	Payload Equipment	Item: 118 Case: III ( $M_{ m PY}$ < 3000)	12,200	2,541
2.	Structure - Basic	$M_{S} = 0.31  (M_{PY}) + 50 = 838  \text{kg}$	0	921
	- Secondary	$10\%$ of $M_S = 84 \text{ kg}$		
	- T/W Penalty	T/W = 0.05; Penalty = 0 kg		
3.	EPS	$M_{E} = 0.0713 \; (P_{o}) + 240 = 1371 \; kg$		1,371
		$P_{E} = 0.067 (P_{O}) + 100 = 1168 W$	1,168	
4.	ACS	$M_A = 0.0294  (M_{PL}) + 64 = 406  \text{kg}$		406
		$P_A = 0.011  (M_{PL}) + 30 = 158  W$	158	
5.	RCS $M_{\rm p} = 0.332  (M_{\rm PL})$	$M_R = 1.2 \text{ (M}_P) = 1.2 \times (3858) = 4630 \text{ kg}$		4,630
	$M_{\mathbf{R}} = M_{\mathbf{P}} + 0.2 M_{\mathbf{P}}$	$P_{R} = 0.008 \; (M_{PY}) + 20 = 40 \; W \; (M_{PY} < 4490)$	40	
9	TCC	$M_{T} = 0.0319 \; (M_{\mathrm{PY}}) + 52 = 133 \; \mathrm{kg}$		133
		$P_{T} = 0.0195 \; (M_{PY}) + 40 = 90 \; W$	06	
7.	TCS	$M_{H} = 0.0175  (M_{PY}) + 52 = 96  \text{kg}$		96
		$P_{H} = 0.0438 \; (M_{PY}) + 100 = 211 \; W$	211	
· ×	Rendezvous & Docking	N/A	N/A	N/A
		Sub Tot:	13,867	10,105
9.	Contingency & Integration	15% of the above power and mass	2,080	1,516
			ч°	$^{ m M_{PL}}$
Z	NO. OF PLATFORMS: 17	TOTALS:	15,947	11,621

PLATFORM MAGE

PLATFORM NO 94eE	2	
FLAIFORM MASS & POWER ESTIMATES	OTV:_OTV, ExpendableO	

	Platform Elements	Estimating Basis	Power,	Mass, ko
1.	Payload Equipment	Item: 119 Case: II (M <sub>D.V</sub> < 2700)	12.200	9 916
2.	Structure	$M_S = 0.35 \ (M_{PV}) + 50 = 1276 \ kg$	0	1.895
	- Secondary	$108 \text{ of M}_{S} = 128 \text{ kg}$		
	T/W Penalty	T/W = 0.64; Penalty = 492 kg		
e5	EPS	$M_{E} = 0.0620 \text{ (P}_{O}) + 210 = 1209 \text{ kg}$		1,209
		$P_{E} = 0.067 (P_{o}) + 100 = 1180 W$	1,180	
4.	ACS	$M_{ m A}$ = 0.0258 ( $M_{ m PL}$ ) + 56 = 259 kg		259
		$P_{A} = 0.011  (M_{PL}) + 30 = 116  W$	116	
5.	RCS	$M_R = 1.2  (M_p) = 1.2 \times (498) = 587  kg$		587
	$M_{\mathbf{R}} = M_{\mathbf{P}} + 0.2 M_{\mathbf{P}}$	$P_{R} = 0.008 \text{ (M}_{P,V}) + 20 = 38 \text{ W (M}_{D,V} < 4400)$	38	
9.	TCC	$M_{\rm T} = 0.0317 \; (M_{\rm PY}) + 45 = 115 \; {\rm kg}$		115
		$P_{T} = 0.0195 \; (M_{P,Y}) + 40 = 83 \; W$	83	
7.	TCS	$M_{H} = 0.0175  (M_{PY}) + 45 = 84  \text{kg}$		84
		$P_{H} = 0.0438 \; (M_{PY}) + 100 = 197 \; W \; (M_{PV} < 2600)$	197	
· ∞	Rendezvous & Docking	$M_{RD} = 0.1175  (M_{PY}) + 200 = 460  kg$		460
		$P_{RD} = 200 \text{ W}$	200	
	;	Sub Tot:	14,014	6,826
G.	Contingency & Integration	15% of the above power and mass	2,102	1,024
Ş.	NO. OF PLATFORMS: 17		о	$M_{PL}$
		TOTALS	16 116	040

	PL	PLATFORM MASS & POWER ESTIMATES	FES	PLATFORM NO. 94eB	NO. 94eB
	OI	OTV: OTV, Expendable	OPER. MODE: B - Non-serviced, 8 year life, replaced	8 year life,	replaced
				Power,	Mass,
		Platform Elements	Estimating Basis	watts	kg
	$\frac{1}{2}$	Payload Equipment	Item: 120 Case: II ( $M_{\mathrm{PY}}$ < 2200)	12,200	1,970
	5.	Structure - Basic	$M_{S} = 0.396  (M_{PY}) + 50 = 830  \text{kg}$	0	1,405
		- Secondary	$108 \text{ of M}_{3} = 83 \text{ kg}$		
		<ul><li>T/W Penalty</li></ul>	T/W = 0.64; Penalty = 492 kg		
	e5	EPS	$M_{ m E}$ = 0.055 ( $_{ m O}$ ) + 187 = 1058 kg		1,058
			$P_{E} = 0.067 (P_{o}) + 100 = 1161 W$	1,161	
(	4.	ACS	$M_A = 0.0228  (M_{PL}) + 50 = 214  kg$		214
G-15			$P_{A} = 0.011  (M_{PL}) + 30 = 109  W$	109	
25	5.	$RCS \qquad M_{\rm p} = 0.166 \; (M_{\rm pL})$	$M_R = 1.2 \text{ (M}_p) = 1.2 \times (1194) = 1433 \text{ kg}$		1,433
		$M_{\rm E} = M_{\rm P} + 0.2 M_{\rm P}$	$P_{R} = 0.008  (M_{PY}) + 20 = 36  W  (M_{PY} < 4400)$	36	
	9.	TCC	$M_{T}$ = 0.0306 ( $M_{PY}$ ) + 40 = 100 kg		100
			$P_{T} = 0.0195 \; (M_{PY}) + 40 = 78 \; W$	78	
	7.	TCS	$M_{H} = 0.0175  (M_{PY}) + 40 = 74  kg$		74
			$P_{H} = 0.0438  (M_{PY}) + 100 = 186  W$	186	
	· ·	Rendezvous & Docking	N/A	N/A	N/A
			Sub Tot:	13,770	6,255
	9.	Contingency & Integration	15% of the above power and mass	2,066	938
				4	:
				7°	$^{ m MPL}$
	NO	NO. OF PLATFORMS: 17	TOTALS:	: 15,836	7,193

PLATFORM MASS & POWER ESTIMATES OTV: IOTV, Expendable

PLATFORM MASS & POWER ESTIMATES

0	OTV: OTV, L. T. Expendable	OPER. MODE: 3 yr consumables supply	ріу	
	Platform Elements	Estimating Basis	Power, watts	Mass, kg
1	Payload Equipment	Item: 122 Case: II (Mpv < 2700)	12,700	2,306
2.	Structure - Basic	$M_S = 0.35  (M_{PY}) + 50 = 1307  \text{kg}$	0	1,438
	- Secondary	$108 \text{ of M}_{S} = 131 \text{ kg}$		
	- T/W Penalty	T/W = 0.07; Penalty = 0 kg		
ъ,	EPS	$M_E = 0.0620 (P_o) + 210 = 1248 kg$		1,248
		$P_{E} = 0.067 (P_{o}) + 100 = 1222 W$	1,222	
4	ACS	$M_A = 0.0258  (M_{PL}) + 56 = 248  \text{kg}$		248
		$P_A = 0.011  (M_{PL}) + 30 = 112  W$	112	
5.	RCS $M_{\rm p} = 0.0623  (M_{\rm pL})$	$M_R = 1.2  (M_P) = 1.2 \times (464) = 556  kg$		556
	$M_{\mathbf{R}} = M_{\mathbf{P}} + 0.2 M_{\mathbf{P}}$	$P_{R} = 0.008 \text{ (M}_{PY}) + 20 = 38 \text{ W (M}_{PV} < 4400)$	38	
9.	TCC			118
		$P_{\rm T} = 0.0195 \; (M_{\rm PV}) + 40 = 85 \; W$	85	
7.	TCS			85
		$P_{H} = 0.0438 \text{ (M}_{PY}) + 100 = 201 \text{ W (M}_{PY} < 2600)$	201	
∞	Rendezvous & Docking	$M_{RD} = 0.1175 \; (M_{PY}) + 200 = 471 \; kg$		471
		$P_{RD} = 200 \text{ W}$	200	
		Sub Tot:	14,558	6,470
6.	Contingency & Integration	15% of the above power and mass	2,184	971
			ч°	$M_{\mathrm{PL}}$
Š	NO. OF PLATFORMS: 16	TOTALS:	16 741	7 441

PLATFORM MASS & POWER ESTIMATES

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OTHU.		5 5	PLATFORM NO. 95VE	O. 95vE
. v 10	OTV: 4 STD IUS, (2L, 2L)	OPER. MODE: 3 yr consumables supply	, life, ipply	
Pla	Platform Elements		Power,	Mass
1 Dowley	2	Estimating Basis	watts	ke
	Ξ	Item: 123 Case: II (Mpy < 2700)	12,700	9 308
	1	$M_{S} = 0.35  (M_{PY}) + 50 = 1307  \text{kg}$	0	2,300
	Secondary	$108 \text{ of M}_{\mathbf{S}} = 131 \text{ kg}$	i	2
3 FPG	- T/W Penalty	T/W = 1.93; Penalty = 857 kg		
		[+]		1.249
4 ACS		$ m P_{E} = 0.067 \; (P_{_{ m O}}) \; + \; 100 = 1223 \; W$	1,223	
		$^{ m M}_{ m A}$ = 0.0258 ( $^{ m M}_{ m PL}$ ) + 56 = 277 kg		977
5 D C C		$^{\rm P}_{\rm A} = 0.011 \; (\rm M_{\rm PL}) + 30 = 124 \; W$	124	
	$^{M}_{P} = 0.0623  (^{M}_{PL})$	$M_{R} = 1.2 (M_{p}) = 1.2 \times (533) = 640 \text{ kg}$		640
O TCC	$^{M}R = ^{M}P + 0.2 M_{P}$	$P_{R} = 0.008 \text{ (M}_{PY}) + 20 = 38 \text{ W} \text{ (M}_{PV} < 4400)$	38	040
		$M_{\rm T} = 0.0317 \; (M_{\rm PY}) + 45 = 118 \; {\rm kg}$		118
7. TCS		$P_{T} = 0.0195  (M_{PY}) + 40 = 85  W$	82	
		$M_{H} = 0.0175  (M_{PY}) + 45 = 85  \text{kg}$		ά
Donald		$^{ m P}_{ m H}$ = 0.0438 (M $_{ m PY}$ ) + 100 = 201 W (M $_{ m PY}$ < 2600)	201	8
	menuezvous & Docking	$\Xi$		471
		$P_{RD} = 200 \text{ W}$	200	
9. Conting	Contingency & Integration	Sub Tot:	14,571	7,440
		13% of the above power and mass	2,186	1,116
NO. OF PLATFORMS:	TFORMS: 16		P 0	$^{ m M}_{ m PL}$
		CUATOI	16,756	8 556

G-128

PLATFORM NO. 95vB

OT	OTV: 4 STG IUS (2L, 2L)	OPER. MODE: B - Non-servided, 8 year life, replaced	8 year life,	replaced
	rlatform Elements	Estimating Basis	Power, watts	Mass, kg
-:	Payload Equipment	Item: 124 Case: III (Mpy < 2200)	12,700	2,050
2.	Structure - Basic	$M_S = 0.396  (M_{PY}) + 50 = 862  \text{kg}$	0	1,805
	- Secondary	$108 \text{ of M}_{S} = 86 \text{ kg}$		
	- T/W Penalty	T/W = 1.93; Penalty = 857 kg		
3.	EPS	$M_{\rm E} = 0.055 \; (P_{_{\rm O}}) + 187 = 1093 \; {\rm kg}$		1,693
		$P_{E} = 0.067 (P_{o}) + 100 = 1204 W$	1,204	
4	ACS	$M_A = 0.0228 \text{ (M}_{PL}) + 50 = 232 \text{ kg}$		232
		$P_A = 0.011 \text{ (M}_{PL}) + 30 = 118 \text{ W}$	118	
5.	RCS $M_{p} = 0.166 (M_{pL})$	$M_{\rm R} = 1.2 \; (M_{\rm P}) = 1.2 \times (1327) = 1593 \; {\rm kg}$		1,593
	$M_{\mathbf{R}} = M_{\mathbf{P}} + 0.2 M_{\mathbf{P}}$	$P_{R} = 0.008 \text{ (M}_{PY}) + 20 = 36 \text{ W (M}_{PY} < 4400)$	36	
9.	TCC	$M_{T} = 0.0306  (M_{PY}) + 40 = 103  kg$		103
		$P_T = 0.0195  (M_{PY}) + 40 = 80  W$	80	
7.	TCS	$M_H = 0.0175  (M_{PY}) + 40 = 76  \text{kg}$		16
		$P_{H} = 0.0438 \text{ (M}_{PX}) + 100 = 190 \text{ W}$	190	
œ.	Rendezvous & Docking	N/A	A/N	N/A
		Sub Tot:	14,328	6,952
9.	Contingency & Integration	15% of the above power and mass	2,149	1,043
			a°	$M_{ m PL}$
Z	NO. OF PLATFORMS: 16	TOTALS:		7,995

	PLA	PLATFORM MASS & POWER ESTIMATES	ES	PLATFORM NO. 95dB	10. 95dB
J	OT	OTV: OTV, L. T. Expendable	OPER. MODE: B - Non-serviced, 8 year life, replaced	8 year life, 1	replaced
		Platform Elements	Estimating Basis	Power,	Mass, kg
	1.	Payload Equipment	Item: 125 Case: II (Mpv < 2200)	12,700	2,050
••	2.	Structure - Basic	$M_S = 0.396  (M_{PX}) + 50 = 862  \text{kg}$	0	948
		- Secondary	$10\%$ of $M_S = 86$ kg		
		- T/W Penalty	T/W = 0.07; Penalty = 0 kg		
	3.	EPS	$M_{ m E} = 0.055 \; (P_{ m O})  +  187 = 1092 \; { m kg}$		1,092
			$P_{E} = 0.067 (P_{O}) + 100 = 1203 W$	1,203	
	4.	ACS	$M_A = 0.0228 \ (M_{PL}) + 50 = 202 \ Fg$		202
G-13			$P_A = 0.011  (M_{PL}) + 30 = 103  W$	103	
	5.	RCS $M_{\rm P}=0.166~(M_{\rm pL})$	$M_{ m R} = 1, 2  (M_{ m p}) = 1.2   imes (1107) = 1329  { m kg}$		1,329
		$M_{\mathbf{R}} = M_{\mathbf{P}} + 0.2 M_{\mathbf{P}}$	$P_{\rm R} = 0.008  (M_{\rm PX}) + 20 = 36  \text{W}  (M_{\rm PY} < 4400)$	36	
	. 9	TCC	$M_T = 0.0306 \ (M_{PY}) + 40 = 103 \ kg$		103
			$P_{T} = 0.0195 \; (M_{PY}) + 40 = 80 \; W$	80	
	7.	TCS	$M_H = 0.0175  (M_{PY}) + 40 = 76  \text{kg}$		92
			$P_{H} = 0.0438  (M_{PX}) + 100 = 190  W$	190	
30	· •	Rendezvous & Docking	N/A	N/A	N/A
			Sub Tot:	14,312	5,800
51	9.	Contingency & Integration	15% of the above power and mass	2,147	870
				P o	M <sub>PT.</sub>
2	20.	NO. OF PLATFORMS: 16	TOTALS:	-	6,670

PLATFORM MASS & POWER ESTIMATES

OTV: OTV, Expendable	C' - Non-serviced, 16 yr life,	PLATFORM NO 16 yr life, shed at 8 yrs	). oanc.
	or the MODE: Consumation replem		
Platform Elements	Retinating Design	Power,	Mass,
1 Desired	Tormaring Dasis	watts	kg
rayload Equi	Item: 126 Case: III $(M_{p,V} \ge 3000)$	16,600	3.418
2. Structure - Basic	$M_S = 0.225  (M_{PX}) + 300 = 1069  \text{kg}$	0	1.892
- Secondary	$108 \text{ of M}_{\rm S} = 107 \text{ kg}$		
- T/W Penalty	T/W = 0.43; Penalty = 716 kg		
3. EPS	$M_{E} = 0.0609 (P_{o}) + 200 = 1525 kg$		1,525
	${ m P_E} = 0.067 \; ({ m P_O}) + 100 = 1558 \; { m W}$	1,558	
4. ACS	$M_A = 0.0294 \ (M_{PL}) + 64 = 405 \ kg$		405
	A A	158	
5. RCS $M_{\rm P}=0.166~(M_{\rm PL})$	MR		2 319
$M_{\mathbf{R}} = M_{\mathbf{P}} + 0.2 M_{\mathbf{P}}$	Ь	47	î
6. TCC		:	191
	11	107	
7. rcs	.11		112
	$P_{H} = 0.0438  (M_{PX}) + 100 = 250  W$	250	
8. Rendezvous & Docking	$M_{RD} = 0.0193  (M_{PY}) + 200 = 266  kg$		266
	$P_{RD} = 200 \text{ W}$	200	
	Sub Tot:	18,919	10,001
<ol> <li>Contingency &amp; Integration</li> </ol>	15% of the above power and mass	2,838	1,514
NO. OF PLATFORMS: 12		ь О	$^{ m M_{PL}}$
	TOTALS	01 757	

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	Platform Elements	Estimating Basis	Power,	Mass, kg
Ļ,	Payload Equipment	Item: 127 Case: III (Mpy > 2700)	16,600	2,981
2	Structure - Basic	$M_S = 0.259  (M_{PY}) + 300 = 1072  \text{kg}$	0	1,791
	- Secondary	$10\% \text{ of M}_{S} = 107 \text{ kg}$		
	- T/W Penalty	T/W = 0.51; Penalty = 612 kg		
3	EPS	$M_{E} = 0.0620 \; (P_{o}) + 210 = 1555 \; kg$		1,555
		$P_{\rm E} = 0.067 \; (P_{\rm o}) + 100 = 1553 \; W$	1,553	
4	ACS	$M_A = 0.0258 \text{ (M}_{PL}) + 56 = 296 \text{ kg}$		296
			132	
5.	RCS			694
	$M_{\mathbf{R}} = M_{\mathbf{P}} + 0.2 M_{\mathbf{P}}$	$P_{R} = 0.008 \text{ (M}_{PY}) + 20 = 44 \text{ W (M}_{PY} < 4400)$	44	
9	TCC	$M_T = 0.0317 \text{ (M}_{PY}) + 45 = 139 \text{ kg}$		139
		$P_T = 0.0195  (M_{PY}) + 40 = 98  W$	86	
7.	TCS			16
		$P_{H} = 0.0438 \text{ (M}_{PY}) + 100 = 231 \text{ W (M}_{PY} \ge 2600)$	231	
8	Rendezvous & Docking	$M_{RD} = 0.0388  (M_{PV}) + 400 = 516  kg$		516
		$\frac{P_{RD}}{RD} = 200 \text{ W}$	200	5
		Sub Tot:	18,858	8,069
9.	9. Contingency & Integration	15% of the above power and mass	2,829	1,210
			Ь	M <sub>PI.</sub>
Ž	NO OF PLATFORMS: 12	TOTALS	91 697	0

	•	OF EA. MODE: E NOT SELVICED OF SELVICED IN THE LEGISLE.	ď	piaced
	Platform Elements	Estimating Basis	rower,	Mass, kg
Τ.	Payload Equipment	Item: 128 Case: III (M $_{ m PY} \stackrel{>}{_{\sim}} 2200$ )	16,600	2,650
2.	Structure - Basic	$M_S = 0.29  (M_{PY}) + 300 = 1069  kg$	0	1,787
	- Secondary	$10\% \text{ of M}_{S} = 107 \text{ kg}$		
	- T/W Penalty	T/W = 0.51; Penalty = 612 kg		
33	EPS	$M_E = 0.055 (P_o) + 187 = 1364 kg$		1,364
		$P_{\rm E} = 0.067 \; (P_{\rm O}) + 100 = 1534 \; W$	1,534	
4.	ACS	$M_A = 0.0228 \text{ (M}_{PL}) + 50 = 263 \text{ kg}$		263
		$P_A = 0.011 \text{ (M}_{PL}) + 30 = 133 \text{ W}$	133	
5.	RCS $M_{\rm p} = 0.166  (M_{\rm PL})$	$M_{ m R}$ = 1.2 (M $_{ m p}$ ) = 1.2 × (1553) = 1864 kg		1,864
	$M_{\overline{R}} = M_{\overline{P}} + 0.2 M_{\overline{P}}$	$P_{ m R} = 0.008 \; (M_{ m PY})  +  20  =  4 { m j} \; W \; (M_{ m PY}  <  4400)$	41	
9		$M_{T} = 0.0306 \text{ (M}_{PY}) + 40 = 121 \text{ kg}$		121
		$P_{T} = 0.0195  (M_{PY}) + 40 = 92  W$	92	
7.	TCS	$M_{H} = 0.0175  (M_{PY}) + 40 = 86  \text{kg}$		26
		$P_{H} = 0.0438 \; (M_{PY}) + 100 = 216 \; W$	216	
œ	Rendezvous & Docking	N/A	N/A	N/A
		Sub Tot:	18,616	8,137
9.	Contingency & Integration	15% of the above power and mass	2,792	1,221
			Ч°	$M_{PL}$
N	NO OF BLATFORMS: 19	TOTALS	91 400	0 26 0

PLATFORM MASS & POWER ESTIMATES

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1	Platform Elements	Estimating Racio	Power,	Mass,
1	1. Payload Equipment	Item: 190 Com: Trr	watts	kg
2	2. Structure - Basic	$^{\circ}$ Case: III (Mp > 3000)	16,600	3,612
	- Secondary	$_{ m S} = 0.226 \; ({ m M}_{ m PY}) + 300 = 1113 \; { m kg}$	0	1,224
	- T/W Penalty	T/W = 0.05; Penalty = 0 kg		
3.	. EPS	$M_{ m E} = 0.0609 \; (P_{ m O})  +  200 = 1525 \; { m kg}$		1 595
4	000	${ m P}_{ m E}$ = 0.067 (P <sub>o</sub> ) + 100 = 1558 W	1,558	
<b>G</b> -1	200	M		384
2	BCS	PA	150	
		M R		2,169
9		P R	49	
5		$M_{T} = 0.0319 \; (M_{PY}) + 52 = 167 \; kg$		167
1		$^{\mathrm{P}}_{\mathrm{T}}$ = 0.0195 ( $^{\mathrm{M}}_{\mathrm{PY}}$ ) + 40 = 110 W	110	
	ICS	$M_{H} = 0.0175  (M_{PY}) + 52 = 115  kg$		115
٥		$P_{H} = 0.0438 \; (M_{PY}) + 100 = 258 \; W$	258	111
0	nendezvous & Docking	$M_{ m RD}$ = 0.0193 ( $M_{ m PY}$ ) + 200 = 270 kg		270
		$P_{RD} = 200 \text{ W}$	200	
9.	Contingency & Intermetica	Sub Tot:	18,926	9,466
	a megianon	15% of the above power and mass	2,839	1,420
ON	NO. OF PLATFORMS: 12	O TA PROFF	d o	$^{ m M_{PL}}$
		IOIALS	21.765	10 000

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 96gE	OPER. MODE: E-serviced, 16 yr, life, 3 yr consumables supply	Power Mass.
TFORM MASS & POWER ESTIMATES	7: IOTV, L.T. Reusable	

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Platform Elements	Estimating Basis	rower,	Mass, kg
Payload Equipment	Item: 130 Case: III ( $M_{ m pY} \ge 2700$ )	16,600	3,150
Structure - Basic	$M_{\rm S} = 0.259 \; (M_{\rm PY}) + 300 = 1116 \; {\rm kg}$	0	1,374
- Secondary	$108 \text{ of M}_{S} = 112 \text{ kg}$		
- T/W Penalty	T/W = 1.08; Penalty = 147 kg		
EPS	$M_E = 0.0620 (P_o) + 210 = 1555 kg$		1,555
	$P_{E} = 0.067 (P_{o}) + 100 = 1554 W$	1,554	
ACS	$M_A = 0.0258 \ (M_{PL}) + 56 = 288 \ kg$		288
	$P_A = 0.011  (M_{PL}) + 30 = 129  W$	129	
RCS $M_p = 0.9623  (M_{pL})$	$M_{R} = 1.2  (M_{P}) = 1.2 \times (559) = 671  \text{kg}$		671
$M_{B} = M_{P} + 0.2 M_{P}$	$P_{R} = 0.008 \text{ (M}_{PY}) + 20 = 45 \text{ W (M}_{PY} < 4400)$	45	
TCC	$M_T = 0.0317  (M_{PY}) + 45 = 145  \text{kg}$		145
	$P_T = 0.0195 \text{ (M}_{PY}) + 40 = 101 \text{ W}$	101	
TCS	$M_H = 0.0175  (M_{PY}) + 45 = 100  k_{S}$		100
	$P_{H} = 0.0438 \text{ (M}_{PY}) + 100 = 238 \text{ W (M}_{PY} \ge 2600)$	00) 238	
Rendezvous and Docking	$M_{RD} = 0.0388 \; (M_{PY}) + 400 = 522 \; kg$		522
	$P_{RD} = 200 \text{ W}$	200	-
	Sub Tot	18,867	7,806
Contingency and Integration	15% of the above power and mass	2,830	1,171
	- DAMES	ь 0	$^{ m M_{PL}}$

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& POWER	OTV L.T. Expendable
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PLATFORM MASS & POWER ESTIMATES	OI

replaced Mass.	kg kg	2,800	1,365	249	1,739	126	89	N/A	7,591	1,135	M <sub>PL</sub> 8,730
year life.	Power, watts	16,600		1,535	126	42	95	223 N/A	18,261	2.793	P <sub>o</sub> 21,414
S. OPER. MODE: B - Non-serviced, 8 year life, replaced	aland series a	Item: 131 Case: III ( $M_{PY} \ge 2200$ ) $M = 0.29 (M_{DV}) + 300 = 1112 \text{ kg}$	$_{10\%}^{S}$ of $_{111}^{M}$ kg $_{117}^{M}$ = 0.06; Penalty = 0 kg $_{127}^{M}$ = 0.06; $_{127}^{M}$ = 1365 kg	$M_{E} = 0.055 (P_{O}) + 180 = 1505 mB$ $P_{E} = 0.067 (P_{O}) + 100 = 1535 W$ $M_{C} = 0.0228 (M_{C}) + 50 = 249 kg$	$_{ m A}^{ m A}$ = 0.011 (M $_{ m PL}^{ m D}$ ) + 30 = 126 W $_{ m A}^{ m A}$ = 1.2 × (1449) = 1739 kg	$_{ m R}^{ m R} = 0.008 \; (M_{ m PY}) + 20 = 42 \; W \; (M_{ m PY}) < 4400)$	$_{\rm T}^{\rm T}$ = 0.0195 (M <sub>PY</sub> ) + 40 = 95 W $_{\rm T}^{\rm T}$ = 0.0175 (M ) + 40 = 89 kg	$_{\rm H}^{\rm P} = 0.0438 \; (M_{\rm PY}) + 100 = 223 \; W$	N/A Sub Tot	15% of the above power and mass	TOTALS:
PLATFORM MASS & POWER ESTIMATES		Platform Elements Payload Equipment	Structure - Basic - Secondary - T/W Penalty	EPS		RCS $M_P = 0.166  (M_{PL})$ $M_R = M_P + 0.2  M_P$	. TCC	. TCS	8. Rendezvous and Docking	9. Contingency and Integration	
LA	OTV:	-:		3.	<del>√</del> G-13	5.	.9	7.	00	0,	

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NO. OF PLATFORMS:

PLATFORM MASS & POWER ESTIMATES			
OTV, L.T. Reusable	OPER. MODE: C - Non-serviced, 16 year life	16 year life	
Platform Elements	Estimating Basis	Power, watts	Mass, kg
Payload Equipment	Item: 132 Case: III ( $M_{\mathrm{PY}} \ge 3000$ )	18,100	3,780
Structure - Basic	$M_{\rm g} = 0.225  (M_{\rm PY}) + 300 = 1151  \text{kg}$	0	1,266
- Secondary	108  of M = 115  kg		
- T/W Penalty	T/W = 0.035; Penalty = 0 kg		
EPS	$M_{\rm E} = 0.0713 \; (P_{\rm A}) + 240 = 1914 \; \rm kg$		1,914
	$P_{\rm c} = 0.067 \; (P_{\rm c}) + 100 = 1673 \; W$	1,673	
ACS	$M_{A} = 0.0294 \text{ (M}_{PL}) + 64 = 551 \text{ kg}$		551
	$P_A = 0.011 \text{ (M}_{PL}) + 30 = 212 \text{ W}$	212	
RCS $M_{\rm D} = 0.332  (M_{\rm DI})$	$M_{\rm B} = 1.2  (M_{\rm p}) = 1.2  \times (5498) = 6597  \text{kg}$		6,597
$M_{R} = M_{P} + 0.2 M_{P}$	$P_{R} = 0.008 \; (M_{PY}) + 20 = 50 \; W \; (M_{PY} < 4400)$	20	
TCC	$M_T = 0.0319 \ (M_{PY}) + 52 = 173 \ kg$		173
	$P_T = 0.0195  (M_{PY}) + 40 = 114  W$	114	
TCS	$M_{\rm H} = 0.0175 \; (M_{\rm PV}) + 52 = 118 \; \text{kg}$		118
	$P_{H} = 0.0438  (M_{PY}) + 100 = 266  W$	266	
Rendezvous and Docking	N/A	N/A	N/A
	Sub Tot	20,415	14,398
Contingency and Integration	15% of the above power and mass	3,062	2,160
		ч°	$M_{\mathrm{PL}}$
NO. OF PLATFORMS: 11	TOTALS:	23,477	16,558

PLATFORM NO. 98nB	viced, 8 year life, replaced
	OPER, MODE; B - Non-service
PLATFORM MASS & POWER ESTIMATES	OTV: OTV, Expendable

PLATFORM NO. 98nB

			Power,	Mass,
	Platform Elements	Estimating Basis	watts	kg
1.	Payload Equipment	Item: 133 Case: III ( $M_{\rm PY} \ge 2200$ )	21,000	3,500
2.	Structure - Basic	$M_{\rm S} = 0.29 \; (M_{ m PX}) + 300 = 1315 \; { m kg}$	0	2,163
	- Secondary	$108 \text{ of M}_{S} = 132 \text{ kg}$		
	- T/W Penalty	T/W = 0.43; Penalty = 716 kg		
3.	EPS	$M_{ m E} = 0.055 \; (P_{ m O}) + 187 = 1672 \; { m kg}$		1,672
		$P_{\rm E} = 0.067 \; (P_{\rm O}) + 100 = 1909 \; W$	1,909	
4.	ACS	$M_A = 0.0228 \text{ (M}_{PL}) + 50 = 319 \text{ kg}$		319
		$P_A = 0.011  (M_{PL}) + 30 = 160  W$	160	
5.	RCS $M_p = 0.166  (M_{PL})$	$M_{\rm R} = 1.2  (M_{\rm p}) = 1.2 \times (1957) = 2348  \text{kg}$		2,348
	$M_{\rm R} = M_{\rm P} + 0.2 M_{\rm P}$	$P_{R} = 0.008 \text{ (M}_{PY}) + 20 = 48 \text{ W (M}_{PY} < 4400)$	48	
9.	TCC	$M_{\rm T} = 0.0306 \; (M_{\rm PY}) + 40 = 147 \; {\rm kg}$		147
		$P_{T} = 0.0195 \text{ (M}_{PY}) + 40 = 108 \text{ W}$	108	
7.	TCS	$M_{H} = 0.0175  (M_{PX}) + 40 = 101  \text{kg}$		101
		$P_{H} = 0.0438 \; (M_{PY}) + 100 = 253 \; W$	253	
8	Rendezvous and Docking	N/A	N/A	N/A
		Sub Tot	23,479	10,250
9.	Contingency and Integration	15% of the above power and mass	3,522	1,538
			ьо	$M_{ m PL}$
NO	NO. OF PLATFORMS: 9	TOTALS:	27,001	11,788

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 98nE	OPER. MODE: E-serviced, 16 yr life, 3 yr consumables supply
PLATFORM MASS & POWER ESTIMATES	OTV: OTV, Expendable

	Platform Elements	Estimating Basis	Fower,	Mass, kg
1.	Payload Equipment	Item: 134 Case: III (Mpy > 2700)	21,000	3,938
2.	Structure - Basic	$M_S = 0.259  (M_{PX}) + 300 = 1320  \text{kg}$	0	2,168
	- Secondary	$10\% \text{ of M}_{S} = 132 \text{ kg}$		
	- T/W Penalty	T/W = 0.43; Penalty = 716 kg		
3.	EPS	$M_{ m E} = 0.0620 \; (P_{ m o}) \; + \; 210 = 1902 \; { m kg}$		1,902
		$P_{E} = 0.067 (P_{o}) + 100 = 1928 W$	1,928	
4.	ACS	$M_{A} = 0.0258  (M_{PL}) + 56 = 355  \text{kg}$		355
			157	
5.	RCS $M_p = 0.0623  (M_{PL})$	$M_{ m R} = 1.2 \; (M_{ m p}) = 1.2 \times (721) = 865 \; { m kg}$		865
	$M_{\mathbf{R}} = M_{\mathbf{P}} + 0.2 M_{\mathbf{P}}$	$P_{\rm R} = 0.008  (M_{\rm PV}) + 20 = 52  \text{W}  (M_{\rm DV} < 4400)$	52	
. 9	TCC	$M_{T} = 0.0317 \text{ (M}_{PY}) + 45 = 170 \text{ kg}$		170
		$P_{T} = 0.0195 \text{ (M}_{PY}) + 40 = 117 \text{ W}$	117	
7.	TCS	$M_{H} = 0.0175  (M_{PY}) + 45 = 114  \text{kg}$		114
		$P_{H} = 0.0438 \text{ (M}_{PY}) + 100 = 272 \text{ W (M}_{PV} \ge 2600)$	272	
8	Rendezvous and Dccking	$M_{RD} = 0.0388 \text{ (M}_{PY}) + 400 = 553 \text{ kg}$		553
		$P_{RD} = 200 \text{ W}$	200	
		Sub Tot	23,726	10,064
9.	Contingency and Integration	15% of the above power and mass	3,559	1,510
02	NO. OF PLATFORMS:	TOTALS	P 0	M <sub>PL</sub>

OTV: OTV, L.T. Expendable	OPER. MODE: B - Non-serviced,	year life, replaced	placed
Platform Elements	Estimating Basis	Power, watts	Mass, kg
1. Pavload Equipment	Item: 135 Case: III (Mpv > 2200)	21,000	3,500
	$M_{\rm g} = 0.9 \ (M_{\rm p, Y}) + 300 = 1315 \ {\rm kg}$	0	1,447
- Sccondary	$108 \text{ of M}_{S} = 132 \text{ kg}$		
- T/W Penalty	T/W = 0.05; Penalty = 0 kg		
3. EPS	$M_{\rm E} = 0.055  (P_{\rm A}) + 187 = 1671  \text{kg}$		1,671
	11	1,908	
4. ACS	$M_{\star} = 0.0228  (M_{\rm DJ}) + 60 = 294  \text{kg}$		294
	$P_{\star} = 0.011 \text{ (M}_{\text{DI}}) + 30 = 147 \text{ W}$	147	
5. RCS $M_{\odot} = 0.166  (M_{\odot})$	$_{\rm D}^{\rm A}$ = 1.2 ( $_{\rm D}^{\rm A}$ ) = 1.2 × (1773) = 2128 kg		2,128
Σ	$P_{D} = 0.008 \text{ (M}_{DQ}) + 20 = 48 \text{ W (M}_{PQ} < 4400)$	48	
<u>.</u>	$M_{xx} = 0.0306 \text{ (M}_{Dy}) + 40 = 147 \text{ kg}$		147
	$P_m = 0.0195  (M_{D,V}) + 40 = 108  W$	108	
7. TCS	$M_{H} = 0.0175  (M_{PY}) + 40 = 101  \text{kg}$		101
	$_{\rm H}^{\rm P} = 0.0438 \; ({\rm M}_{\rm DV}) \; + \; 100 = \; 253 \; {\rm W}$	253	,
8. Rendezvous and Docking	N/A	N/A	N/A
	Sub Tot	23,466	9,288
9. Contingency and Integration	15% of the above power and mass	3,520	1,393
		Ь	MpL
4	*DU# 41 G	96 985	10 681

OTV: OTV, L.T. Expendable

OPER. MODE: E-serviced, 16 yr life, 3 yr consumables supply

		Platform Elements	Estimating Basis	Power, watts	Mass, kg
	1.	Payload Equipment	Item: 136 Case: III $(M_{PY} \ge 2700)$	21,000	3,938
	2.	Structure - Basic	$M_{S} = 0.259 (M_{PY}) + 300 = 1320 \text{ kg}$	0	1,452
		- Secondary	$10\% \text{ of M}_{S} = 132 \text{ kg}$		
		- T/W Penalty	T/W = 0.05; Penalty = 0 kg		
	3.	EPS	$M_{E} = 0.0620 \text{ (P}_{O}) + 210 = 1901 \text{ kg}$		1,901
			$P_{E} = 0.067 (P_{O}) + 100 = 1927 W$	1,927	
	4.	ACS	$M_A = 0.0258  (M_{PL}) + 56 = 331  \text{kg}$		331
G-141			$P_A = 0.011 (M_{PL}) + 30 = 147 W$	147	
1	5.	$RCS M_{p} = 0.0623 (M_{PL})$	$M_{R} = 1.2 (M_{p}) = 1.2 \times (663) = 796 \text{ kg}$		796
		$M_{R} = M_{P} + 0.2 M_{P}$	$P_{R} = 0.008  (M_{PY}) + 20 = 52  W  (M_{PY} < 4400)$	52	
	6.	TCC	$M_{T} = 0.0317 (M_{PY}) + 45 = 170 \text{ kg}$		170
			$P_{T} = 0.0195 \text{ (M}_{PY}) + 40 = 117 \text{ W}$	117	
	7.	TCS	$M_{H} = 0.0175 (M_{PY}) + 45 = 114 \text{ kg}$		114
			$P_{H} = 0.0438  (M_{PY}) + 100 = 272  W  (M_{PY} \ge 260)$	0) 272	
	8.	Rendezvous and Docking	$M_{RD} = 0.0388  (M_{PY}) + 400 = 553  kg$		553
			$P_{RD} = 200 W$	200	
		,	Sub Tot	23,715	9,253
	9.	Contingency and Integration	15% of the above power and mass	3,557	1,388
				Po	$^{ m M}_{ m PL}$
	NO.	OF PLATFORMS: 9	TOTALS:	27,273	10,641

PLATFORM MASS & POWER ESTIMATES	OPER. MODE: replenished at 8 yrs	yr me, com	
OTV, L.T. Reusable		Power,	Mass,
	Estimating Busis	waits	kg
Platform Elements	197 000	25,000	5,031
Payload Equipment	: His	0	1,575
Structure - Basic	M = 0.223  (Mpy)		
Secondary	$10\% \text{ of M}_{S} = 143 \text{ kg}$		
T/W Penalty	T/W = 0.035; Penalty = 0 kg		2 174
	$M_E = 0.0609 (P_Q) + 200 = 2174 \text{ kg}$		1
	$P_{\perp} = 0.067 (P_{\perp}) + 100 = 2272 W$	2,2,7	
	$\frac{E}{M} = 0.0294 \text{ (M}_{DT}) + 64 = 499 \text{ kg}$		499
	A	193	
4	$_{\rm A}^{\rm FA} = 0.000 \times 10^{-3}  {\rm Mpc}^2$ $_{\rm A}^{\rm FA} = 1.2 \times (2458) = 2950  {\rm kg}$	IN T	2,950
$= 0.166  (M_{PL})$	$^{1}$ R = 1.2 (p) $^{2}$ = 20 W (M <sub>2.7</sub> > 4400)	09	
$= M_{\rm p} + 0.2 M_{\rm p}$	$R = 0.008  (M_{\rm PY})^{-1}                                                                                                                                                                                                                                                                                                                                                 $		209
	$M_T = 0.0263 \text{ (M}_{PY})$ + 40 = 138 W	138	,
	$T$ $T$ $M$ = 0.0175 ( $M_{2.0}$ ) + 52 = 140 kg		140
	$^{P.1}$ H $^{P.1}$ P = 0.0438 (M <sub>2.7</sub> ) + 100 = 320 W	320	
	-		297
Rendezvous ar.d Docking	RD	200	
	$P_{RD} = 200 \text{ W}$ Sub Tot	28,183	12,876
	sen pur cross of mass	4,228	1,931
Contingency and Integration	15% of the above power and man	ь	$^{ m MpL}$
	TOTALS:	43,522	14,807

PLAT OTV:	PLATFORM MASS & POWER ESTIMATES OTV: 2 STG. OTV, L.T. Expendable	OPER. MODE: C - Non-service,	PLATFORM NO. 66kC	. 66kC
	Platform Elements	Estimating Basis	Power, watts	Mass, kg
1.	Payload Equipment	Item: 138 Case: III $(M_{PV} \ge 3000)$	25,000	5,031
2.	Structure - Basic	$M_{\rm S} = 0.225  (M_{\rm py}) + 300 = 1432  \text{kg}$	0	1,575
	- Secondary	10% of M = 143 kg		
	- T/W Penalty	T/W = 0.024; Penalty = 0 kg		
3.	EPS	$M_{\rm E} = 0.0713 \; (P_{\rm o}) + 240 = 2540 \; {\rm kg}$		2,540
		$P_{E} = 0.067 (P_{O}) + 100 = 2261 W$	2,261	
4.	ACS	$M_A = 0.0294 \text{ (M}_{DL}) + 64 = 700 \text{ kg}$		100
		$P_A = 0.011  (M_{DI}) + 30 = 268  W$	268	
5.	RCS $M_{\rm p} = 0.332  (M_{\rm DT})$	$M_{\rm p} = 1.2  (M_{\rm p}) = 1.2  \times (7184) = 8621  \text{kg}$		8,621
	$M_{\mathbf{D}} = M_{\mathbf{D}} + 0.2 M_{\mathbf{D}}$	$P_{B} = 0.008 \text{ (M}_{PY}) + 20 = 60 \text{ W (M}_{PY} \ge 4400)$	09	
9	TCC	$M_T = 0.0263  (M_{PV}) + 77 = 209  \text{kg}$		209
		$P_T = 0.0195 \text{ (M}_{PV}) + 40 = 138 \text{ W}$	138	
7.	TCS	$M_{H} = 0.0175  (M_{DV}) + 52 = 140  \text{kg}$		140
		$P_{H} = 0.0438 \text{ (M}_{PV}) + 100 = 320 \text{ W}$	320	
8	Rendezvous and Docking	N/A	N/A	N/A
		Sub Tot	28,047	18,816
9.	Contingency and Integration	15% of the above power and mass	4,207	2,822
			,	:
			d o	$^{ m M_{PL}}$
ON	NO. OF PLATFORMS: 7	TOTALS:	32,264	21, 638

PLATFORM NO. 68jB

OPER. MODE: B - Non-serivced. 8 year life, replaced

	-	Platform Elements	Estimating Basis	Power, watts	Mass, kg
	1.	Payload Equipment	Item: 139 Case: III (M <sub>PY</sub> > 2200)	31,700	5,400
	2.	Structure - Basic	$M_g = 0.29 (M_{PY}) + 300 = 1866 \text{ kg}$	0	2,053
		- Secondary	10% of M <sub>S</sub> = 187 kg	*	
		- T/W Penalty	T/W = 0.035; Penalty = 0 kg		
	3.	EPS	$M_E = 0.055 (P_O) + 187 = 2418 \text{ kg}$		2,418
			$P_{E} = 0.067 (P_{O}) + 106 = 2817 W$	2,817	
	4.	ACS	$M_A = 0.0228 (M_{PL}) + 50 = 411 \text{ kg}$		411
1,			$P_A = 0.011 (M_{PL}) + 30 = 204 W$	204	
44	5.	RCS $M_p = 0.166 (M_{PL})$	$M_R = 1.2 (M_p) = 1.2 \times (2629) = 3155 \text{ kg}$		3,155
		$M_{R} = M_{P} + 0.2 M_{P}$	$P_{R} = 0.008  (M_{PY}) + 20 = 63  W  (M_{PY} \ge 4400)$	63	
	6.	TCC	$M_{T} = 0.026  (M_{PY}) + 60 = 200  kg$		200
			$P_{T} = 0.0195  (M_{PY}) + 40 = 145  W$	145	
	7.	TCS	$M_{H} = 0.0175 (M_{PY}) + 40 = 135 \text{ kg}$		135
			$P_{H} = 0.0438  (M_{PY}) + 100 = 337  W$	337	
	8.	Rendezvous and Docking	N/A	N/A_	N/A_
			Sub Tot	35,267	13,772
	9.	Contingency and Integration	15% of the above power and mass	5,290	2,066
			•		
				Po	$^{ m M}_{ m PL}$
	NO.	OF PLATFORMS: 6	TOTALS:	40,556	15,838

OPER. MODE: E-serviced, 16 yr life, 3 yr consumables supply

OTV: 2 STG. OTV, L.T. Reusable

			I DMCI	i com
	Platform Elements	Estimating Basis	watts	kg
-:	Payload Equipment	Item: 140 Case: III ( $M_{\rm py} \ge 2700$ )	31,700	6,075
2.	Structure - Basic	$M_S = 0.259 \text{ (M}_{PY}) + 300 = 1873 \text{ kg}$	0	2,061
	- Secondary	$10\% \text{ of M}_{S} = 187 \text{ kg}$		
	- T/W Penalty	T/W = 0.035; Penalty = 0 kg		
3.	EPS	$M_{ m E} = 0.0620 \; (P_{ m o}) + 210 = 2743 \; { m kg}$		2,743
		$P_{\rm F} = 0.067 \ (P_{\rm O}) + 100 = 2838 \ W$	2,838	
4.	ACS	$M_{\Lambda} = 0.0258 \text{ (M}_{DL}) + 56 = 457 \text{ kg}$		457
		$P_A = 0.011 \text{ (M}_{PI}) + 30 = 201 \text{ W}$	201	
5.	RCS $M_p = 0.0623  (M_{PL})$	$M_{R} = 1.2 \text{ (M}_{p}) = 1.2 \times (968) = 1162 \text{ kg}$		1,162
	$M_{\rm R} = M_{\rm P} + 0.2 M_{\rm P}$	$P_{R} = 0.008 \text{ (M}_{PY}) + 20 = 69 \text{ W (M}_{PY} \ge 4400)$	69	
9.	TCC	$M_T = 0.0262 \text{ (M}_{PY}) + 68 = 227 \text{ kg}$		227
		$P_{T} = 0.0195  (M_{PY}) + 40 = 158  W$	158	
7.	TCS	$M_H = 0.0175  (M_{PY}) + 45 = 151  \text{kg}$		151
		$P_{H} = 0.0438 \text{ (M}_{PY}) + 100 = 366 \text{ W (M}_{PY} \ge 2606)$	366	
8	Rendezvous and Docking	$M_{RD} = 0.0388  (M_{PX}) + 400 = 636  \text{kg}$		636
		$P_{BD} = 200 \text{ W}$	200	
		Sub Tot	35,532	13,512
9.	Contingency and Integration	15% of the above power and mass	5,330	2,027
			ьо	$^{ m M}_{ m PL}$
SIX	NO OF DIATEORMS.	TOTALS:	40,865	16,193

PLATFORM MASS & POWER ESTIMATES

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			OPER MODE E-Serviced 16 115	ON MINO	COLE
			and the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of t	yr consum	ables supply
	)	Platform Elements	Estimating Resis	Power,	Mass,
	-	. Payload Equipment	The state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the s	watts	kg
	2		m: 141 Case: III ( $M_{PY} \ge 2700$ )	31,700	6.019
		Section 2	+ 300 = 1259 kg	0	9 895
			$10\% \text{ of } M_S = 186 \text{ kg}$	,	670,7
	c		T/W = 0.31; Penalty = 780 kg		
	٠,	EPS	$M_{ m E} = 0.0620 \; (P_{ m o}) + 210 = 2744 \; { m kg}$		
	•				2,744
G-	;	ACS	$= 0.0258  (M_{\rm pr}) + 56 = 474  \text{kg}$	2,838	
146	U				474
		KCS	$M_{\rm R} = 1.2 \; (M_{\rm p}) = 1.2 \times (1009) = 1911 \; {\rm kg}$	208	
		$^{\rm M}_{ m R}$	$P_{D} = 0.008 \text{ (M)} + 20 = 69 \text{ m/m}$		1,211
	. 9		M = 0.0369  AM	89	
					226
	7.	TCS	$_{\rm T}^{\rm P} = 0.0195  ({ m M_{PY}}) + 40 = 157  { m W}$	157	
			$M_{\rm H} = 0.0175  (M_{\rm py}) + 45 = 150  \rm kg$		
			(M)		150
	· 00	Rendezvous and Docking	= 0.0388 (M ) 1.400 (C) (PY = 2000)	364	
			RD ("PY + 400 = 434 kg		434
			$^{1}$ RD $^{-}$ Z00 W	200	
	9.	Contingency and Inc.	5 Tot	35,535	14 081
		de la la la la la la la la la la la la la	15% of the above power and mass 5.3		9 119
2	0	NO. OF PLATEORIES	d	-	,112
e j		OF THATFORMS: 0	TOTAIS: 40 955		T
					16,193

PLATFORM MASS & POWER ESTIMATES OTV: 2 STG. OTV, L.T. Expendable

ment Item: 142 Case: III ( $M_{PY} \ge 3000$ ) asic $M_S = 0.225 (M_{PY}) + 300 = 2216 kg$ lo% of $M_S = 222 kg$ $W$ Penalty $W_S = 0.024$ ; Penalty $W_S = 0.024$ ; Penalty $W_S = 0.0609 (P_O) + 200 = 3449 kg$ $W_S = 0.0609 (P_O) + 100 = 3675 W$ $W_S = 0.0609 (P_O) + 100 = 3675 W$ $W_S = 0.0294 (M_{PL}) + 64 = 767 kg$ $W_S = 0.0294 (M_{PL}) + 64 = 767 kg$ $W_S = 0.011 (M_{PL}) + 30 = 293 W$ $W_S = 1.2 \times (3971) = 4765 kg$ $W_S = 1.2 \times (3971) = 4765 kg$ $W_S = 0.098 (M_{PY}) + 20 = 88 W (M_{PY} \ge 4400)$ $W_S = 0.0263 (M_{PY}) + 20 = 88 W (M_{PY} \ge 4400)$ $W_S = 0.0195 (M_{PY}) + 100 = 473 W$ $W_S = 0.0195 (M_{PY}) + 100 = 473 W$ $W_S = 0.0438 (M_{PY}) + 100 = 473 W$ $W_S = 0.0438 (M_{PY}) + 200 = 367 kg$ $W_S = 200 W$			8-16		
asic $M_S = 0.225  (M_{PY}) + 300 = 2216  kg$ scendary $M_S = 0.225  kg$ $M_S = 222  kg$ $M_S = 222  kg$ $M_S = 0.024; Penalty = 0  kg$ $M_S = 0.024; Penalty = 0  kg$ $M_S = 0.0609  (P_0) + 200 = 3449  kg$ $M_S = 0.067  (P_0) + 100 = 3675  W$ $M_S = 0.0294  (M_{PL}) + 64 = 767  kg$ $M_S = 0.011  (M_{PL}) + 30 = 293  W$ $M_S = 0.011  (M_{PL}) + 30 = 293  W$ $M_S = 0.011  (M_{PL}) + 20 = 88  W  (M_{PY}) + 400 = 206  W$ $M_S = 0.008  (M_{PY}) + 77 = 301  kg$ $M_S = 0.0195  (M_{PY}) + 40 = 206  W$ $M_S = 0.0195  (M_{PY}) + 100 = 473  W$ $M_S = 0.0193  (M_{PY}) + 100 = 473  W$ $M_S = 0.0193  (M_{PY}) + 200 = 364  kg$ $M_S = 200  W$ $M_S = 200  M$ $M$		Platform Elements	Estimating Basis	Power,	Mass,
asic $\frac{M_S}{S} = 0.225 \; (M_{PY}) + 300 = 2216 \; kg$ 10% of $M_S = 222 \; kg$ T/W = 0.024; Penalty = 0 kg $M_E = 0.0609 \; (P_O) + 200 = 3449 \; kg$ $M_E = 0.0609 \; (P_O) + 100 = 3675 \; W$ $M_A = 9.0294 \; (M_{PL}) + 64 = 767 \; kg$ $M_R = 1.2 \; (M_P) + 100 = 3675 \; W$ $M_R = 1.2 \; (M_P) + 100 = 3675 \; W$ $M_R = 1.2 \; (M_P) + 100 = 3675 \; kg$ $M_R = 1.2 \; (M_P) + 100 = 293 \; W$ $M_R = 1.2 \; (M_P) + 100 = 293 \; W$ $M_R = 1.2 \; (M_P) + 100 = 293 \; W$ $M_R = 1.2 \; (M_P) + 100 = 206 \; W$ $M_R = 0.0195 \; (M_{PY}) + 40 = 206 \; W$ $M_R = 0.0195 \; (M_{PY}) + 52 = 201 \; kg$ $M_R = 0.0193 \; (M_{PY}) + 200 = 367 \; kg$ $M_R = 0.0193 \; (M_{PY}) + 200 = 367 \; kg$ $M_R = 0.0193 \; (M_{PY}) + 200 = 367 \; kg$ $M_R = 0.0193 \; (M_P) + 200 = 367 \; kg$ $M_R = 0.0193 \; (M_P) + 200 = 367 \; kg$ $M_R = 0.0193 \; (M_P) + 200 = 367 \; kg$ $M_R = 0.0193 \; (M_P) + 200 = 367 \; kg$ $M_R = 0.0193 \; (M_P) + 200 = 367 \; kg$ $M_R = 0.0193 \; (M_P) + 200 = 367 \; kg$ $M_R = 0.0193 \; (M_P) + 200 = 367 \; kg$ $M_R = 0.0193 \; (M_P) + 200 = 367 \; kg$ $M_R = 0.0193 \; (M_P) + 200 = 367 \; kg$		Payload Equipment	Item: 142 Case: III (M > 2000)		0
condary		Structure - Basic	M = 0 005 (M	41,460	8,514
We penalty T/W = 0.024; Penalty = 0 kg T/W = 0.024; Penalty = 0 kg T/W = 0.024; Penalty = 0 kg T/W = 0.0609 ( $P_0$ ) + 200 = 3449 kg $P_E$ = 0.067 ( $P_0$ ) + 100 = 3675 W $P_E$ = 0.0294 ( $P_E$ ) + 64 = 767 kg $P_A$ = 0.011 ( $P_E$ ) + 30 = 293 W $P_E$ = 0.011 ( $P_E$ ) + 20 = 88 W ( $P_E$ ) = 4400) $P_E$ = 0.008 ( $P_E$ ) + 20 = 88 W ( $P_E$ ) $P_E$ = 0.008 ( $P_E$ ) + 77 = 301 kg $P_E$ = 0.0195 ( $P_E$ ) + 40 = 206 W $P_E$ $P_E$ = 0.0195 ( $P_E$ ) + 100 = 473 W $P_E$ = 0.0193 ( $P_E$ ) + 200 = 36; kg $P_E$ = 0.0193 ( $P_E$ ) + 200 = 36; kg $P_E$ = 200 W $P_E$ Sub To:		School	$_{\rm S}$ = 0.223 (M <sub>PY</sub> ) + 300 = 2216 kg	0	2,437
W Penalty T/W = 0.024; Penalty = 0 kg $ M_{E} = 0.0609 \; (P_{O}) + 200 = 3449 \; kg \\ P_{E} : 0.067 \; (P_{O}) + 100 = 3675 \; W \\ M_{A} = 0.0294 \; (M_{PL}) + 64 = 767 \; kg \\ P_{A} = 0.011 \; (M_{PL}) + 30 = 293 \; W \\ M_{R} = 1.2 \; (M_{P}) = 1.2 \times (3971) = 4765 \; kg \\ P_{R} = 0.008 \; (M_{PY}) + 20 = 88 \; W \; (M_{PY} \ge 4400) \\ M_{A} = 0.0263 \; (M_{PY}) + 77 = 301 \; kg \\ P_{T} = 0.0195 \; (M_{PY}) + 40 = 206 \; W \\ M_{H} = 0.0175 \; (M_{PY}) + 100 = 473 \; W \\ M_{H} = 0.0175 \; (M_{PY}) + 100 = 473 \; W \\ P_{H} = 0.0438 \; (M_{PY}) + 200 = 367 \; kg \\ P_{RD} = 200 \; W \\ Sub \; Tot \; M_{RD} = 0.0193 \; (M_{PY}) + 200 = 367 \; kg \\ P_{RD} = 200 \; W \\ Sub \; Tot \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P_{E} \; P$			10%  of M = 222  kg		
$\begin{array}{llllllllllllllllllllllllllllllllllll$		ı	T/W = 0.024; Penalty = 0 kg		
$P_{E} = 0.067 (P_{o}) + 100 = 3675 W$ $M_{A} = 0.0294 (M_{PL}) + 64 = 767 kg$ $P_{A} = 0.011 (M_{PL}) + 30 = 293 W$ $M_{R} = 1.2 (M_{P}) = 1.2 \times (3971) = 4765 kg$ $P_{R} = 0.008 (M_{PY}) + 20 = 88 W (M_{PY} \ge 4400)$ $M_{A} = 0.0263 (M_{PY}) + 77 = 301 kg$ $P_{T} = 0.0195 (M_{PY}) + 40 = 206 W$ $M_{H} = 0.0175 (M_{PY}) + 100 = 473 W$ $M_{H} = 0.0175 (M_{PY}) + 100 = 473 W$ $M_{RD} = 0.0193 (M_{PY}) + 200 = 367 kg$ $P_{RD} = 200 W$ $Sub \ Tot$ $P_{RD} = 200 W$ $Sub \ Tot$ $P_{RD} = 200 W$		3PS	$M_E = 0.0609 (P_O) + 200 = 3449 kg$		9 440
$ \begin{array}{llllllllllllllllllllllllllllllllllll$			${}^{P}_{E} = 0.067 \; ({}^{P}_{o}) + 100 = 3675 \; W$	3,675	
$ \begin{array}{llllllllllllllllllllllllllllllllllll$					767
$ \begin{array}{llllllllllllllllllllllllllllllllllll$		SS M = 0.160 cm	$P_{A} = 0.011 \ (M_{PL}) = 30 = 293 \ W$	293	
$P_{R} = 0.008 \text{ (M}_{PY}) + 20 = 88 \text{ W (M}_{PY} \ge 4400)$ $M_{Y} = 0.0263 \text{ (M}_{PY}) + 77 = 301 \text{ kg}$ $P_{T} = 0.0195 \text{ (M}_{PY}) + 40 = 206 \text{ W}$ $M_{H} = 0.0175 \text{ (M}_{PY}) + 52 = 201 \text{ kg}$ $P_{H} = 0.0438 \text{ (M}_{PY}) + 100 = 473 \text{ W}$ $M_{RD} = 0.0193 \text{ (M}_{PY}) + 200 = 36.7 \text{ kg}$ $P_{RD} = 200 \text{ W}$ $Sub \text{ Tot}$ $P_{RD} = 200 \text{ W}$ $15\% \text{ of the above power and mass}$ $P_{P} = 95$		M = M + 0.2M	$M_R = 1.2 (M_p) = 1.2 \times (3971) = 4765 \text{ kg}$		4,765
$\begin{array}{llllllllllllllllllllllllllllllllllll$		R MP V. Z MP	$^{P}_{R} = 0.008 \text{ (M}_{PY}) + 20 = 88 \text{ W (M}_{PY} \ge 4400)$		
$P_{T} = 0.0195 \text{ (M}_{PY}) + 77 = 301 \text{ kg}$ $P_{T} = 0.0195 \text{ (M}_{PY}) + 40 = 206 \text{ W}$ $M_{H} = 0.0175 \text{ (M}_{PY}) + 52 = 201 \text{ kg}$ $P_{H} = 0.0438 \text{ (M}_{PY}) + 100 = 473 \text{ W}$ $M_{RD} = 0.0193 \text{ (M}_{PY}) + 200 = 367 \text{ kg}$ $P_{RD} = 200 \text{ W}$ $Sub \text{ Tot}$ $15\% \text{ of the above power and mass}$ $P_{P, 2}$		CC	M = 6 0969 /M \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	88	
$P_{T} = 0.0195 \text{ (M}_{PY}) + 40 = 206 \text{ W}$ $M_{H} = 0.0175 \text{ (M}_{PY}) + 52 = 201 \text{ kg}$ $P_{H} = 0.0438 \text{ (M}_{PY}) + 100 = 473 \text{ W}$ $M_{RD} = 0.0193 \text{ (M}_{PY}) + 200 = 362 \text{ kg}$ $P_{RD} = 200 \text{ W}$ $Sub \text{ Tot}$ $15\% \text{ of the above power and mass}$ $P_{P, 1} = 0.0195 \text{ (M}_{PY}) + 200 = 362 \text{ kg}$ $P_{RD} = 200 \text{ W}$			ĺ		301
$M_{\rm H} = 0.0175 \; (M_{\rm PY}) \; + 52 = 201 \; \rm kg$ $P_{\rm H} = 0.0438 \; (M_{\rm PY}) \; + 100 = 473 \; \rm w$ $M_{\rm RD} = 0.0193 \; (M_{\rm PY}) \; + 200 = 362 \; \rm kg$ $P_{\rm RD} = 200 \; \rm w$ $Sub \; {\rm fot}$ Integration 15% of the above power and mass		S. C.	$F_{\rm T} = 0.0195  (M_{\rm PY}) + 40 = 206  \text{W}$	206	
$P_{\rm H} = 0.0438 \; (M_{\rm PY}) \; + \; 100 = 473 \; W$ $M_{\rm RD} = 0.0193 \; (M_{\rm PY}) \; + \; 200 = 362 \; {\rm kg}$ $P_{\rm RD} = 200 \; W$ $Sub \; {\rm Tot}$ Integration 15% of the above power and mass		1	$M_{H} = 0.0175  (M_{PY}) + 52 = 201  \text{kg}$		201
Docking $M_{ m RD}=0.0193~(M_{ m PY})$ + 200 = 36.1 kg $^{ m P}_{ m RD}=200~W$ Sub Tot Integration 15% of the above power and mass	R	and outside the second	$P_{H} = 0.0438  (M_{PY}) + 100 = 473  W$	473	
$P_{RD}$ = 200 W Sub Tot	110	and Tocking			354
Sub Yot Integration 15% of the above power and mass				200	8
The shower and mass	Co	ntingency and Internation	Sub Tot	46,395	20,798
		and micelanion	15% of the above power and mass	6,929	3,120
	OF	NO. OF PLATFORMS: 5		7°	$^{ m M}_{ m PL}$

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PLATFORM MASS & POWER ESTIMATES	Expendable
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	Platform Elements	Estimating Basis	Power, watts	Mass,
Τ.	Payload Equipment	Item: 143 Case: III ( $M_{pY} \ge 2200$ )	50,840	8,200
2.	Structure - Basic	$M_S = 0.29 \ (M_{PY}) + 300 = 2678 \ kg$	0	2,946
	- Secondary	$108 \text{ of M}_{S} = 268 \text{ kg}$		
	- T/W Penalty	T/W = 0.024; Penalty = 0 kg		
3.	EPS	$M_{E} = 0.055 (P_{o}) + 187 = 3749 \text{ kg}$		3,749
		$P_{E} = 0.067 (P_{o}) + 100 = 4439 W$	4,439	
4.	ACS	$M_A = 0.0228 \; (M_{ m PL}) + 50 = 592 \;  m kg$		592
		$P_{A} = 0.011  (M_{PL}) + 30 = 292  W$	292	
5.	RCS $M_p = 0.166  (M_{pL})$	$M_{ m R}$ = 1.2 ( $M_{ m p}$ ) = 1.2 × (3948) = 4738 kg		4,738
	$M_{R} = M_{P} + 0.2 M_{P}$	$P_{R} = 0.008 \text{ (M}_{PY}) + 20 = 86 \text{ W (M}_{PY} \ge 4400)$	98	
.9	TCC	$M_{T} = 0.026  (M_{PX}) + 60 = 273  \text{kg}$		273
		$P_{T} = 0.0195  (M_{PY}) + 40 = 200  W$	200	
7.	TCS	$M_{H} = 0.0175  (M_{PY}) + 40 = 184  \text{kg}$		184
		$P_{H} = 0.0438  (M_{PY}) + 100 = 459  W$	459	
8	Rendezvous and Docking	N/A	N/A	N/A
		Sub Tot	56,316	20,682
9.	Contingency and Intomotion		1	

64,763

PLATFORM MASS & POWER ESTIMATES

PLATFORM NO. 100KE	OPER. MODE: E-serviced, 16 yr life, 3 yr consumables supply
PLATFORM MASS & POWER ESTIMATES	OTV: 2 STG. OTV, L.T. Expendable

		o Davis	Power,	Mass, ko
	Platform Elements	Estimating Basis	Watto	9
:	Payload Equipment	Item: 144 Case: III ( $M_{\mathrm{PY}} \geq 2700$ )	50,840	9,225
01	Structure - Basic	$M_{\rm g} = 0.259  (M_{\rm PX}) + 300 = 2689  {\rm kg}$	0	2,958
	- Secondary	108  of M = 269  kg		
	- T/W Penalty	T/W = 0.024; Penalty = 0 kg		
3	EPS	$M_{\rm E} = 0.0620 \; (P_{\rm A}) + 210 = 4246 \; {\rm kg}$		4,246
		$P_E = 0.067 (P_S) + 100 = 4461 W$	4,461	
4.	ACS	$M_{A} = 0.0258 \text{ (M}_{DI}) + 56 = 652 \text{ kg}$		652
		$P_A = 0.011 \text{ (M}_{PL}) + 30 = 284 \text{ W}$	284	
5.	RCS $M_S = 0.0623  (M_{DI})$	$M_{D} = 1.2 \text{ (M}_{D}) = 1.2 \times (1439) = 1727 \text{ kg}$		1,727
	$M_{\Sigma} = M_{\Sigma} + 0.2 M_{\Sigma}$	$P_{D} = 0.008 \text{ (M}_{DV}) + 20 = 94 \text{ W}$	94	
9	TCC K			310
		$P_{Tr} = 0.0195 \text{ (M}_{PV}) + 40 = 220 \text{ W}$	220	
7.	TCS	$M_{_{DL}} = 0.0175  (M_{_{DQ}}) + 45 = 206  \text{kg}$		206
		$P_{IJ} = 0.0438 \text{ (M}_{DV}) + 100 = 504 \text{ W (M}_{PV} \ge 2600)$	00) 504	
· ∞	Rendezvous and Docking	$M_{PD} = 0.0388  (M_{PY}) + 400 = 758  \text{kg}$		758
		$P_{BB} = 200 \text{ W}$	200	
		Sub Tot	56,603	20,081
6	Contingency and Integration	15% of the above power and mass	8,490	3,012
			Ро	$M_{ m PL}$
		TOTALS	65.094	23,093